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AN INTERESTING BRAKING EQUIPMENT.

One of the most important parts of the equipment of an electric car is assuredly the brake, and it seems strange that the development and application of braking systems should have lagged so far behind the advance made in the other features of street-car equipment. Until recent years the old appliances which gave some sort of satisfaction when animal traction was used, were depended upon, the only precaution being to make them stronger and make it possible for the driver to apply a somewhat greater pressure to the brake-shoes.

A feature which is marked in bringing about a change in an industry is the fact that, to be successful, the change must be more radical than would at first seem necessary. For example, two horses were all that were required for drawing the ordinary horse-car, and when it was attempted to apply the electric motor, the inventor assumed that if he used a four or five-horse-power motor he would be doing all that could be required; yet there is no doubt that the failure of all the early attempts to apply the electric motor to street railway service was due, in part, to the small power of the motors. The conditions were underestimated, and the motor was far too small for the work required of it. Of course, there were other features of the equipment which gave trouble and led to breakdowns, and it was necessary to remedy these, before success was attained. But it was not until the power of the equipment was greatly increased that it could be shown that the electric motor would come up to the requirements. Not until two motors, each rated at about fifteen horse-power, were adopted as the standard equipment was the running of the car satisfactory; and it was not long before this had been raised to two twenty-five-horse-power motors for all except level roads.

It seems strange that it should be necessary to place mechanical apparatus in a car which is rated at more than twenty times the animal power that used to move the older vehicles; but this is due first to the fact that the cars are larger, and hence heavier, and they must run at a higher speed; and also to the fact that a horse is capable, for a short time, of working at a considerably greater rate than one horse-power. In other words, he has a large overload rating. On the other hand the electric motor is rated for that power which it can perform continuously. Its ordinary performance is usually considerably less than this.

With this example before street railway engineers it would seem that the necessity for making a radical change in the method of braking would have been recognized sooner; yet even to-day one may see large cars, moved by powerful equipments,

depending upon a single hand brake differing but little, except in its power, from the old brake of the horse-car days. This fact is the stranger when it is remembered that during the time the electric railway was coming into prominence a change in the braking system of steam roads was made compulsory. Thus there was available a well-developed mechanical braking system; and, moreover, it was soon realized that the electric equipment itself offered a very effective method of stopping cars. In a number of cities, it is true, electric brakes of various types, or air brakes, were adopted, and these greatly improved those systems by bringing the car under better control and increasing the safety of the passengers. Yet it is strange that the change from the old system to a newer one was so slow, and stranger still that it has not yet been made in all large cities.

It is this feature, the slowness with which the improved systems of braking have been adopted that makes the new system which has been developed at Cronenberg, Germany, particularly interesting, as it illustrates the fact that when severe and peculiar requirements are presented they may often be met with ease. The road referred to is a line about four and one-half miles long, and forms a branch of the road which connects Cronenberg and Elberfeld. On this branch there are a number of long grades with an incline of about ten per cent, and the local authorities insisted that in addition to two hand brakes, all the cars running over this line should be equipped with a special safety brake to prevent any car from running away on the steepest grade under any conditions whatever.

The first method adopted was to lay rack rails between the two running rails, and place on the car a pinion which would engage with the rack. A centrifugal speed controller was driven by the pinion, and if the speed became excessive it automatically applied a brake to the pinion shaft. While comparatively simple, the rack-and-pinion method was unsatisfactory because the use was so severe that it was frequently out of order and the repairs were large.

The rack-and-pinion method was then abandoned, the rack rails were taken up and replaced by two smooth flat rails placed a couple of inches higher than the running rails. On the cars are placed a pair of multipolar electromagnets which are connected in parallel with the motors when on short circuit in the braking position. The magnets are wound so that they present alternate north and south poles to the surfaces of the rails, and as they move along, set up in the rails eddy currents which exert a retarding motion upon the car. Each magnet is mounted on springs, and there is a limiting device preventing it from coming in contact with the braking rails, thus avoiding any mechanical shocks. The two magnets can be made to exert a retarding force of about 8,000 pounds, which is sufficient to cause the car to run down the steepest grade at a slow speed. As the braking rails are placed only on the grades, the magnetic brakes do not come into action except at these points, so that the system is more or less automatic. At other points the usual method of braking by short-circuiting the motors is adopted, and this excites the braking magnets; but they exert their retarding force only when the car is over the braking rails. The system has been in use for some time, and it is said that it has given much satisfaction and that the up-keep is practically nothing.

Certainly there is no other method of propelling vehicles which makes possible so many different ways of braking and retarding as the electric, and it is to be hoped that the day will soon be here when every electric car is equipped with a proper system of braking.

HIGH-EFFICIENCY INCANDESCENT LAMPS.

The description published last week of the silicon lamp, the latest addition to the candidates for the position now held by the carbon incandescent lamp, adds new interest to a topic which has been much discussed during the past two years.

The new lamp has a number of features which distinguish it from certain of its predecessors. While the filament is said to have certain metallic characteristics, the temperature-resistance coefficient seems to indicate that it is really a composite filament having the negative temperature coefficient of carbon combined with a positive metallic coefficient. This composite character also will probably account for the peculiar behavior of the filament due to an increase in the current passed through it. The candle-power, of course, increases with the temperature, as is pointed out, but it reaches a point where the rate of increase in candle-power is not greater than that of the increase in power input. Moreover, it is said that if the temperature be carried still higher, the increase in candle-power is at a lower rate than the power increase; and finally a point seems to be reached where there seems to be no further change in the candle-power of the filament, even though the current be still further increased. Just how far the filament behaves in this way—that is to say, whether there is merely a kink in the candle-power-power curve—remains to be seen, as no data have yet been given out which show how the lamp performs after the point is reached where the candle-power and power become proportional. It would be exceedingly interesting to carry the curve still further, even though there may seem to be no possibility of improving the performance of the filament. A lamp unaffected by voltage variation would be valuable on circuits supplying large motors, even though its efficiency be lower than the best obtainable.

The new lamp may, in a way, be said to be the rejoinder of the carbon filament to the latest attack upon it, for we may consider it as being, in a way, a modified carbon filament; the base is an untreated filament of the ordinary type, and the finished filament differs from the ordinary filament only in the method of flashing. It, therefore, has the advantages of the carbon filament, being rigid and having a high resistivity, but it differs in that it is necessary to treat the filament before it is mounted in the bulb. This fact introduces a few complications, as it is necessary to prevent a strain being thrown on the filament after it is finally mounted. Although the treatment does not appear to weaken the filament, it seems to render it liable to break at points where it is under strain.

This fact may call for certain modifications in the method of mounting, but it does not seem to offer any serious difficulty.

Since the new filament starts from a carbon filament and is superior to the latter by increasing the intrinsic brilliancy, it is apparent that the lamps most easily made will have a high candle-power. Thus, if the watts per candle be reduced to one-third those taken by the normal carbon filament, the candle-power of the filament thus treated would be three times that of the corresponding carbon filament; but, since the treatment itself reduces the resistance of the carbon filament, and thus increases the current which will pass through it, there will be a still further increase in the luminous intensity of the lamp. The new lamp, therefore, shares with the metallic filament lamps the objection of being most easily produced in high candle-power units; but it would seem to be easier to construct lower candle-power "Helion" units in this way than either tantalum or tungsten. Further information regarding this phase of the new development will be awaited with much interest.

As has been pointed out a number of times, an objection which is strongly urged against the new lamps is the tendency to increase our standard of illumination—that is to say, we may be asked to adopt a twenty or thirty-candle-power lamp, or one of even higher rating, in place of the sixteen-candle-power lamp. It is easier, as said before, to make the higher candle-power lamps, and their introduction in place of the lamps we now have would give the lighting companies less uneasiness. Such a change would be unfortunate, because it would make the problem of satisfactory illumination still more difficult, and it does not seem that the ultimate good of the power station would be in that way benefited. But the new lamps are not limited to the field now occupied by the incandescent lamp, for with an efficiency of one watt per candle they can compete with the enclosed arc lamp, and here large units may be employed. For lighting large interiors and for streets and other outdoor use they have many points in their favor. They do away with the arc lamp mechanism, they require less attention, and it should be easier to secure the desired distribution of light. There are thus two fields open for the high-efficiency incandescent lamp, and its fight for their possession will be watched with interest. Possibly it may stimulate the makers of arc lamps to increase the efficiency of their apparatus—in fact, this has already been done; but competition for the field will surely lead to more improvement.

THE CHICAGO ELECTRICAL SHOW.

For two weeks, January 14-26, the Coliseum, Chicago, Ill., has been ablaze with electric lights, the spectacle enhanced with many-colored bunting and the scene enlivened by the attendance of thousands upon thousands of visitors intent upon being introduced to all that the manufacturer has to offer in the form of device and apparatus for the utilization of electricity.

The second annual electrical show held under the auspices of the Electrical Trades Exposition Company has proved a big success. The difficulties encountered before opening, were, apparently, forgotten in the enthusiasm of the first night's attendance, and as the days wore on the satisfaction of those who had made such hearty efforts to make the occasion successful appeared to increase into settled contentment.

TRADE SECRETS.

At a recent meeting of the American Society of Mechanical Engineers Mr. Frederick P. Fish, president of the American Telephone and Telegraph Company, delivered an interesting address, "The Ethics of Trade Secrets." The subject was treated from a lawyer's point of view, yet the ethics of the subject were strongly insisted upon. The law looks upon the subject from the point of view of the greatest public good, and is thus in entire agreement with the accepted ethics. There is an unbroken record of court decisions holding that whatever a man has devised and invented is his own, and until made public property he will be protected in his ownership.

Mr. Fish gave an interesting historical review showing how the present opinions have developed; and he firmly believes that a considerable part of the industrial progress of the past century was due to the recognition of a man's right to profit by any new process which he might devise. It is seldom that a new idea can be carried to a point where the results given are of real value without a considerable expenditure of time, of effort and of money; and unless there be some likelihood of a valuable return for this effort there will be no incentive for making it. While formerly these efforts were generally made by individuals, now they are often carried out by companies employing staffs of skilled workmen. In each case the object sought is the same: a new product, or a better product, or a cheaper method of producing an equally good product which will give the inventor or the manufacturer an advantage over his competitors.

In order that the inventor may reap the results of his labors his right to maintain the secret of his process is recognized. The law must protect him in his rights and prevent any who may necessarily come into knowledge of it from divulging such knowledge. This would also forbid any unfair attempt to learn the secret. The inventor must take the risk of the secret being learned by any number of legitimate methods, and when it is so learned the discoverer has a right to utilize it. If an inspection of the article produced or a chemical analysis will reveal its nature, the analyst has a right to benefit by his knowledge. On the other hand, the law will protect an inventor against this risk for a period of years if he gives his secret to the public. In other words, if he will divulge his invention he may obtain a patent upon it, provided, of course, that it be patentable.

To-day the trade secret plays a smaller part in the industrial world than do patents, but there are certain branches of the industry which depend largely upon secret processes, probably because the methods employed can not, for some reason or other, be patented. Both the trade secret and the patent play a large part in many branches—in fact, in nearly all branches—of electrical engineering. For this reason Mr. Fish's clear discussion of the subject is of much value to electrical engineers, and will be read with great interest.

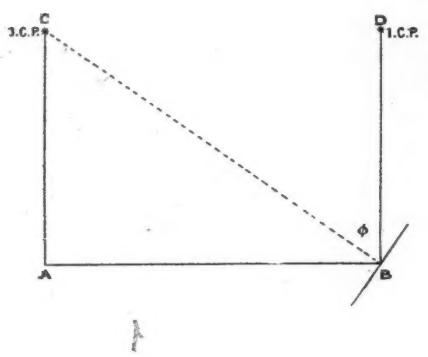
A Photometer for Measuring Illumination.[1]

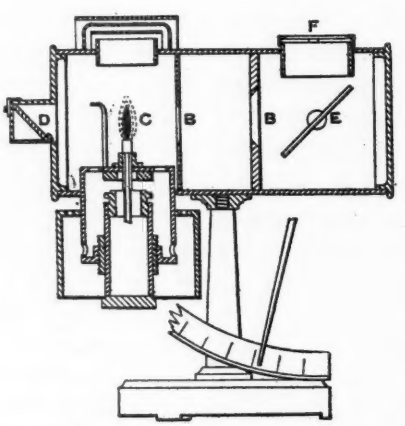
Although it may seem a truism, it is nevertheless a point frequently overlooked that illumination of an object is the ultimate goal of all classes of lights. This not only depends upon the power of the light itself, but on the reflector, the color and character of the surrounding substances, and the position of the object to be illuminated in relation to the light itself. Under most ordinary circumstances, the objects to be illuminated lie either on a horizontal or a vertical plane. On a railway proper, the station platforms are of the former type, and the station walls and wagon sides and ends of the latter.

It is now generally accepted that illumination should be expressed in terms of candles, or portions of a candle, at the distance of a foot, and to the unit of one candle at one foot has been given the name of a foot-candle. This being the case, the theoretical illumination of any point from a single unaided light can be readily obtained. In Fig. 1, if AB be a plane which it is required to illuminate, and C the light (of intensity X candles), the illumination at A, directly under C, is of course $\frac{X}{AC^2}$, AC being expressed in feet. If the illumination at B is required, it will be $\frac{X}{CB^2}$ if the surface to be lighted is at right-angles to the line CB. Along the plane AB, however, this has to be multiplied by the cosine of the angle of incidence, and the illumination is $\frac{X}{CB^2 \times \cos\phi}$. As, however, the known distances are usually CA and AB, this becomes $\frac{X \times CA}{CB^3}$.

[1] Excerpt from a paper entitled "Lighting of Railway Premises" read by Henry Fowler before the Institution of Mechanical Engineers of Great Britain.

If the illumination at B along a vertical plane BD has to be considered, it is $\frac{X \times CD}{CB^3}$. From these simple formulæ it will be seen that the illumination at a point in any plane may be readily determined, always assuming that the intensity X is known for the definite direction CB. In actual practice it is found that with nearly all lights, whether electric or gas, the intensity varies considerably with the angle ACB, and therefore each point must be considered separately. The author has, however, for several years worked with a photometer which measures the total illumination on a horizontal plane with actual examples of lighting, and it is with the results of this work that he proposes to deal. The instrument is a development of the one devised by Preece and Trotter[1] and improved by A. P. Trotter. The apparatus, Fig. 2, consists





Figs. 1 and 2.—Diagram Showing Method of Using Photometer and Cross-Section of Apparatus.

of a cylindrical metal box, with removable ends, which is divided by metal screens BB into three portions. In one the standard of light C is placed, and this consists of a small amylacetate lamp, the wick and burner tube of which can be raised in a tube so that the height of the flame may be kept constant; the proper position is indicated by a pointer. A small mirror D outside the cap of the box allows of observations of the height being taken without removing the cap. In the other portion of the box there is a small pivoted screen E, upon which the light from C is allowed to fall through a hole in the screen B. On E is fastened a piece of white Bristol board. Directly above E is a circular disc F (also of Bristol board) fitted into the top of the box, and in the centre of this disc is a long narrow slot lying at right-angles to the axis of the cylindrical body. In working the instrument the disc F is placed in the plane at the point at which the illumination is required, and the screen E viewed through the slot. The amount of light falling on E will be dependent upon the angle at which it lies relative to the light, and it is therefore moved until the illumination on the screen, as viewed through the slot, balances that on the disc. The amount of illumination in foot-candles is then read off, by the position of a pointer attached to the pivot of the screen, on a scale, the latter having previously been calculated by means of lights of known intensity. When measuring lights of a color different from the reddish tinge of the amylacetate flame, it is necessary to vibrate the screen slightly between the points where the light through the slot appears lighter and darker than the disc. A mean of the maximum and minimum readings will give the correct reading. In all cases some experience with the photometer is necessary before correct results may be expected, but with practice the instrument seems to give reliable results.

The author is perfectly well aware that objection may be raised on the ground that this instrument is not an absolutely correct one, but it is the only one of its kind on the market, and he has found that in the same hands it gives comparable results.

Another and perhaps a more reliable type of portable photometer is that of Simmance and Abady, in which their flicker photometer is used to obtain an absolutely definite reading. The principle of the flicker arrangement and its adaptation to this work has already been described by Abady.[1] It should, however, be pointed out that this is not an illumination photometer, and, although adapted for giving a measure of the illumination from any one light, can not be used for general illumination on a vertical or horizontal plane.

[1] Proceedings, Institution of Civil Engineers of Great Britain, vol. cx, page 69.

Information on Illuminating Engineering.

A prize of $2,600 has been offered by the Cooperative Electrical Development Association for material for a solicitor's handbook. Section 1 of division 2 of this pamphlet is to be devoted to illuminating engineering, and the Holophane Glass Company, New York city, announces that it will be pleased to put the information on the subject of illumination which it has at the service of any one wishing to compete for this prize. The company also offers the services of its engineering department for this purpose.

[1] Journal of Gas Lighting, vol. lxxxv, page 31, etc

Annual Report of the Chicago Telephone Company.

The annual report of President Arthur D. Wheeler, of the Chicago Telephone Company, Chicago, Ill., has been issued. This shows that the gross revenue during the year was $7,907,557.95; the gross expenses, including cost of operation, taxes, maintenance, etc., $6,289,423.57, leaving net earnings of $1,618,144.38. The dividends declared amounted to $1,004,000.

The resources of the company amount to $19,791,436.20. Of this, $16,706,425.90 is the value of the plant, and $1,764,281.40 the value of the real estate and buildings.

The net increase in telephone stations in service was 27,611. Of this number 18,789 were added to the Chicago exchange system, the remainder to the suburban and rural districts. The total number of telephones in service for subscribers at the end of the year was 107,834, the Chicago exchange still having 123,177. Seventy-eight per cent of the stations in the Chicago exchange are upon a measured-service basis. The present mileage of the company is 358,986, an increase of over twenty-three per cent as compared with the previous year. Of this 248,939 miles of wire are under ground, an increase of thirty-three per cent. The number of exchanges is now 162, six new exchanges having been added during the year.

The company continued to negotiate with a committee of the city council upon the subject of an extension of the ordinance rights. A number of proposals were submitted to the committee for new rate and service conditions. Much additional investment would be involved by these changes, as well as material reductions in revenue from the existing body of subscribers. As the reserve fund and surplus and borrowed money have all been expended in increasing the plant, further extensions should not be made until warranted by the investment of additional capital. Six million dollars is given as the lowest estimate which should be expended in 1907 if these changes and extensions should become necessary by the passage of an ordinance based upon the plans now under consideration by the city council.

Wisconsin Electrical Contractors.

The annual winter convention of the Association of Electrical Contractors of Wisconsin was held in Milwaukee on January 15 and 16. Representatives from all of the principal contracting companies in Wisconsin were in attendance.

After the transaction of routine business and the discussion of subjects of mutual interest, officers for the ensuing year were elected, the following gentlemen being selected for the offices named:

President: W. F. Meter, of Oshkosh.

Vice-president: W. G. Pauli, of Racine.

Secretary: Albert Peterman, of Milwaukee.

Treasurer: George Knoerr, of Milwaukee.

Directors: J. D. Warden, of Oshkosh; A. C. Langstadt, of Appleton, and A. R. Schmidt and G. F. Rohn, both of Milwaukee.

The delegates chosen to represent the Wisconsin Association at the convention of electrical contractors, which is to be held in New York city next July, are W. F. Briggs, of Fond du Lac, and Chris Sarau, of Oshkosh; alternates, A. C. Langstadt, of Milwaukee, and W. G. Pauli, of Racine.

It was decided to make the next summer convention of the association partake of the nature of an outing, the place of meeting selected being a chartered steamer, which will take the delegates on an excursion up the Fox river, in Wisconsin.

On the evening of the first day of the convention the delegates banqueted at the Hotel Blatz. Following adjournment on Wednesday, January 16, the delegates visited the works of the Allis-Chalmers Company, the Cutler-Hammer Manufacturing Company and a number of other large plants, devoted in part, or exclusively, to the manufacture of electrical appliances.

The Relative Value of Standards of Light.

At a recent meeting of the French Academy of Sciences J. Violle read a note contributed by A. Perot and Laporte, which gave the results of recent investigations made to compare the relative luminous intensities of the Carcel, the Hefner and the Vernon-Harcourt standards of light. The determinations were made by comparing the three standards directly and indirectly, using in the latter case a secondary standard. Great pains were taken to eliminate all external influences. This was particularly true with regard to the humidity of the air, which was found to affect the lights considerably. The humidity varied from ten to eighteen litres of water vapor per cubic metre of air, and it was found that a correction should be made for the humidity, which was about 0.006 per litre of vapor contained in each cubic metre of air. With this correction made the results of the measurement are as follows: Comparing the Vernon-Harcourt and the Carcel, the ratio was one to one measured both directly and indirectly. Comparing the Hefner and the Carcel by direct measurement the ratio was 0.0932; by indirect, 0.0929. Comparing the Hefner and the Vernon-Harcourt by direct measurement, it was 0.0933; by indirect, 0.0929. The following table gives the mean results of the two methods:

The Unit.	Carcel.	Vernon-Harcourt	Hefner.
Carcel	1	1.001	0.093
Vernon-Harcourt ..	0.996	1	0.0931
Hefner	10.75	10.71	1

The difficulties of making these comparisons calls attention again to the desirability of obtaining some standard of light which will not be influenced by atmospheric conditions.

Telephones at the Automobile Show.

During the recent automobile show held at Madison Square Garden, New York city, an excellent telephone service was provided by the New York Telephone Company. On the main floor over 150 private telephones were installed in the exhibition space of exhibitors. These telephones were connected to the Madison Square exchange, where a section of the switchboard was set apart for them. A special directory of the show numbers was printed, which was sent out to all the telephone company's central offices and public pay-stations in order that those desiring to get in touch with exhibitors at the Garden might do so quickly.

In addition to these private telephones there were two public telephone exchanges in the Garden, with booths and operators, one located in the café just off the main entrance, and one in the rear of the Garden near the Fourth avenue entrance. The amount of business which was done by these telephones was large, for it required fourteen operators and attendants to handle it.

The rathskellar in the basement has been equipped with table telephones, a new style of instrument which the telephone company has recently adopted. Here all one has to do is to ask the waiter for a telephone and it is brought to the table and plugged in on a telephone line which is wired to the table. Telephone calls can thus be received or sent while the person is at lunch.

THE ETHICS OF TRADE SECRETS.[1]

BY FREDERICK P. FISH.

The trade secret that interests us to-day as a practical and substantial feature of our industrial relations can not be considered apart from the law which confines it and alone determinates its extent and character as a thing capable of discussion. In so far as such a secret is protected, it may be regarded as a species of property. It is, however, obviously not tangible property, like lands or chattels. It is not even of the class represented by stocks, bonds or other securities. Its legal recognition implies a right to a thing that is tangible, to an idea or plan. In this respect it may be compared not only with the property in inventions, in so far as the same are protected by letters-patent, but with the limited rights which an author has to his literary productions, and the artist, musician or playwright to the creations of his imaginative effort. It is only at a comparatively high stage of development in a community that the law recognizes and deals with such intangible rights. Early jurisprudence is largely concerned with personal rights and with tangible property. It is during the last hundred years that the right to the intangible properties has for the most part been crystallized into such shape as to be capable of definite expression.

Letters-patent for inventions grew out of the exception in the statute of James I (1623-4), which declared monopolies, so long a source of revenue to the British kings, and of hardship to the subject, to be illegal except when granted for a limited term for a new manufacturer; but the development of patents and of patent law as an essential part of the prevailing industrial scheme, did not really begin either in Great Britain or in this country until well in the nineteenth century.

The definite development of the law of copyright, both that which is based on statute and that which is independent of legislative enactment, is in like manner comparatively modern. The first trade secret case was decided less than one hundred years ago.

In all the classes of rights to which I have referred there is this common: ideas or thoughts or plans or schemes which are of value to the one who rightfully possesses them, are secured to him to a greater or lesser extent by the law.

The trade secret as we know it, as defined and determined by our rules of law which alone give it body and character, is, therefore, a comparatively modern institution. But there was a long history of trade secrets prior to our common law recognition of them.

In all ages many trade secrets have been in the possession of individuals, but for a long period of time they also were a great asset of trading communities and frequently of guilds or associations. Every effort was made to preserve them for the few who had the benefit of them. Always and everywhere those who did not have the secrets sought to learn them. While not as a rule protected by systematic rules of law, kings and governments often intervened to aid their subjects to preserve the secrets they had, and to learn those which they did not know. It seems clear that the right to preserve a trade secret if one could, and to an equal degree the right to get the secret of another by any means not offensive to the moral sense, were always recognized.

A reference to these trade secrets of the olden time, which seems to have had for the most part no definite legal sanction, is only material as affording a basis upon which public sentiment, with the sanction of the law, has given to us our trade secret of to-day. The whole industrial world was permeated with the idea of trade secrets and of their value. As the trades became more and more matters of individual enterprise, it was but natural that, with this history behind them, the sentiment of the community regarded them as a substantial thing to be dealt with on the grounds of public policy. It has dealt with them, through the law, exactly as it has dealt with copyrights and trade-marks, and I believe in a way that is quite in harmony with the general thought of the time.

When our law of trade secrets was first formulated less than a century ago, the industrial conditions were nearly as remote from those of the present day as they were from those of the Middle Ages. The trades had, however, come generally into the hands of individuals. We had started on a line of industrial organization and development which has been consistently followed to the present time. Almost the cardinal principle of this line of development has been the encouragement of the individual to risk and effort. It has been generally recognized that the gain to the community would be the greatest if every member of it was stimulated to do his utmost for himself.

There has never been a time when there were not some dissenters from this general view. And there have been times in which the natural and perhaps inevitable development of current industrial methods has been such as to bring about a revulsion of public sentiment, more or less sound, and more or less justifiable, but at any rate to be taken into consideration as definitely affecting the trend of development of industrial ideas and industrial conditions. But it does not seem possible to deny that the general sentiment has almost always been in favor of the encouragement of the individual in his selfish aspirations for personal prosperity.

I see nothing in the temper of our own times to indicate that this broad view of what is for the common good has been shaken. Few doubt that an individual should get a personal benefit from his personal skill and energy. We know that the entire community profits by the deserved success of any individual in it. We feel instinctively that, if the efforts of individuals are attacked or discouraged, all will suffer. The time may come when different views will prevail, but I do not anticipate that such will be the fact.

It is upon these fundamental principles that the underlying right to the protection of a trade secret, in so far as it is or can be protected, depends. The right is logical and will be asserted and enforced by public sentiment and by the law until we cease to believe that individual effort should be encouraged as the most effective stimulus to industrial improvement.

A trade secret is one method of manipulating or combining materials, or of controlling or directing the forces of nature, or of organizing machinery, or the details of a business, which is the result of original thought, which is of trade value to the person who has the thought, or the right to apply it, and which is kept by him a secret that he may get from it a personal advantage not to be directly shared by his competitors.

The secret, therefore, is the man's own, to keep or to disclose, to use or not to use, as he pleases. No public policy or law can force its disclosure or use. But the one who has it can be encouraged to disclose it or use it, one or both. The patent law offers a reward for the disclosure of secrets of a certain sort, and incidentally encourages their use. The law relating to trade secrets does not tend to promote the disclosure of them, but the contrary. It does encourage their use.

If such secret is of the slightest value, its use as distinguished from its suppression is obviously desirable. The possessor of the secret will get some benefit from its

[1] From an address delivered before the American Society of Mechanical Engineers at New York on January 8.

use; but the community as a whole is far better off if the secret is utilized.

It has never been suggested that the law should go so far as to protect a trade secret that was not a real secret. Such a proposition is entirely inconsistent with the common sense and intelligence of mankind. However brilliant may be a thought or an idea, whether it is of value to the industries or to literature or art, when without dishonesty, fraud or treachery, it has once become known, it is common property. But the law can say, to encourage the use of such a secret, that those who are bound by contract or by good faith to aid in keeping it shall be held to their obligation.

It is just to this extent and no further that trade secrets are protected. The law does not intervene to protect the secret against discovery by fair and honest means. It does not undertake to make the secret, as such, secure. It only enables it to be utilized, for the good of the possessor and of the public, without danger of betrayal by those who must necessarily learn the secret in confidence while it is being operated as a secret, and who can betray it only by what the law regards as a breach of honesty and fair dealing.

There may be others, not directly associated with the work, to whom the secret is imparted in confidence. Is it not proper that they should regard that confidence?

If the law and public sentiment were otherwise, no trade secret could ever be safely put into use. By holding to what seems to be only a fair standard of business ethics, those who gain a knowledge of the secret through a contract or a confidence that is reposed upon them, are prevented from disclosing it, and the desired result is accomplished.

It has been settled by an almost unbroken line of authorities, and it is absolutely clear at the present stage of the law, that a trade secret will be protected against disclosure by any one who has received it in confidence and under such circumstances that there is a contract, express or implied, that the person to whom the secret was disclosed should himself respect it. It follows that there is also a remedy against those who have received a disclosure of the secret from persons guilty of a breach of confidence or of contract in imparting it, unless they themselves were both entirely honest in the matter and protected by the equities of the situation. Against all others the owner has no redress. He can only invoke the power of the law to make effective an obligation to respect his confidence and to live up to an agreement.

For all practical purposes, the views of the courts are based upon a single and simple proposition. An individual is justly and honestly in possession of what is a real trade secret, that is, something useful in his business that is known to him and protected by him to the extent of his power as a secret of his trade. There seems no doubt that this is a real property interest exactly as an invention is property to such an extent that the government can make a contract with reference to it by which it is protected for a limited term by a patent, and exactly as an artistic or literary expression is protected as property. But in any event, it is obviously unfair that those who have entered into a fiduciary relationship with the possessor of the secret, or who by express contract or by a consideration of the relationship must necessarily be said to have assented to an implied contract to protect the secret, should undertake to rob the owner of his secret by communicating it to others or using it themselves. In a large number of the cases that have been before the courts, there has been no express agreement to protect the trade secret. There has been held to be, however, a necessary implication that such an agreement existed because of the relation of service.

But the courts have had no difficulty in the case of trade secrets. Recognizing the propriety of the proposition that they should be protected in cases where breach of confidence or breach of contract was involved, exact and well-defined principles with which the law was familiar, led to intervention by the courts, to see that that was done which was right.

While such cases ordinarily are brought in courts of equity, because, as a rule, an injunction is sought, an action at law may be brought for damages.

The injunction will run not only against the employé, but against those who, with knowledge of the confidential relations, have induced him to betray the secrets.

The vendee of the secret has the same right as the inventor of the secret and may bring a bill against the former employé of the vendor, who acquired the secret in confidence before the sale, provided the employé attempts to divulge the secret wrongfully.

Many trade secrets which are in their nature commercial, that is, business plans or devices, which were special to one who possessed them and useful in his trade, have been in like manner protected by the courts. Examples of these are shown in the following cases:

News agency contract, by which the plaintiff sent news to its subscribers under contract not to divulge it, is enforced in equity.

Contracts of commercial house must be kept secret by a clerk.

Forms and materials for printing advertisements in plaintiff's publication can not be used by his agents for a rival publication.

Confidential attorney's clerk enjoined from publishing extracts from books and papers of his employers or of their clients.

Order books containing customers' names can not be copied by an employé to use later in his own business for soliciting orders.

Perhaps as comprehensive a statement of the general law as any is that of Mr. Justice Story in 2 Story's Equity, Sec. 952, as follows:

Courts of equity will restrain a party from making a disclosure of secrets communicated to him in the course of a confidential employment. And it matters not, in such cases, whether the secrets are secrets of trade or secrets of title, or any other secrets of the party important to his interests.

In some respects the law of trade secrets does not seem quite complete. There have not been sufficient cases arising under sufficiently varying conditions to enable all aspects of the law to be worked out.

For example, under the decisions of the courts there seems to be practically no limit as to the character of the subject matter which may be treated and protected as trade secrets. They may be of small or large importance; they may or may not involve great novelty or real inventive quality. They may be mere business expedients which have a trade value because of their convenience, or because they record useful information. Unlike a patentable invention, it does not seem necessary that they should be "new" as well as useful.

At first sight it might seem that all that was required was that there should be a secret plan or method or device of any kind to entitle its possessor to the limited protection which the law gives.

I doubt, however, if such is ultimately determined to be the law. When cases arise which require a close analysis of the question, it is probable that the courts will decide that there is something necessary over and above the mere question of secrecy to justify the exercise of the power of the court to prevent the use or disclosure by one who acquired his knowl-

edge in confidence or while under contract.

It is well settled that the alleged secret must be a real secret. I believe, however, that before the courts should intervene to protect an alleged trade secret it should appear that it was not only regarded as secret, but that it was distinctly treated carefully as such and guarded by the possessor of it. It should not be enough that he has had it in mind to call it a trade secret, if he ever needed to invoke the protection of the law. He must have taken all necessary and reasonable precautions to prevent its disclosure. Moreover, it does not seem proper that he should have redress against his employés and associates unless it is made to appear that they knew, while occupying the fiduciary relation which gave them the opportunity to learn the secret, that the specific thing now called a secret was in fact regarded and treated as a secret. It should not be enough that one man has worked for another. The employé has a perfect right to grow with his experience. He has a right to carry away for general use everything that he learns in his place or employment, except trade secrets. The public interest requires this as much as it requires that trade secrets should be respected. The employé or associate should be notified of the exact trade secret, that he may know what results of his experience he can and what he can not take away and use freely.

With these qualifications, some of which are perhaps not fully elaborated in the opinions of the judges, there seems no reason to doubt that the law is thoroughly consistent with sound ethical principles. I can conceive of only few directions in which a change of any moment is possible. One would be to the effect that the possessor of a trade secret should publish it to the world so that all might have the advantage of it. Such a law would be incapable of enforcement, for the man who has a thought or an idea can not be forced to express it. Surely, this would result in no benefit to the community. Again, the law might be modified so as to remove the present restrictions against the disclosure of a trade secret by one who thereby is guilty of a breach of trust or of contract. So long as we maintain our present standards of right and wrong, so long as we value and insist upon loyalty and good faith, would not such a change in the law seem to us inconsistent with all that is good in human nature and the application of a principle which is most distinctly immoral?

Believing as I do that the law of trade secrets is fundamentally right and in accord with sound ethical and social principles, at least as gauged by our present standards, I have not turned aside to consider the possible objections to the views that have prevailed. It seems to me that those objections are largely upon a consideration of the obvious hardships involved in the situation. It is a burden that one who knows a useful thing should not have full power to utilize it. Is not this true of every legal restriction upon the individual?

It must not be forgotten that no man need place himself under the embarrassment of knowing a trade secret unless he chooses. Each of us is free to refuse the employment or the relationship or the contract from which such knowledge would come. If we do not refuse, we must as in all other relations in life, accept the situation as a whole, with its burdens as well as its advantages. There is nothing special, as to trade secrets, in this regard.

Neither must it be forgotten that the right to protection in the use of a trade secret is a general right. It is sometimes suggested that while the rules of law, as I have defined them, were adapted to a former condition of things, they are not in harmony with our present industrial situation. I do not think that such is the case.

It is true that in the early years of the last century, when the trade secret of to-day, in its legal relations, was formulated by the courts as a logical development of the general principles of law, the units of trade were small. Trade secrets were then in the possession of small manufacturers, for there were no large ones. In so far as trade secrets play any part in our industries of to-day, they are necessarily, to a large extent, features of our modern corporation and factory system. I do not see how these changes in industrial conditions affect the question under discussion. The reasons which led to the original protection of such secrets against breach of contract or breach of faith one hundred years ago, are sound to-day.

The law on the subject is the same whether the secret is of large or small importance, whether it is possessed by any individual or a corporation. We should not forget that any one of us in this room, and any workman in any factory in the land, may light upon such a secret. If he does, it will have the protection of the law.

A consideration of possibly more moment is that there is offered to the originator of certain special forms of industrial secrets, or to his assignee, the protection afforded by the grant of letters-patent. It may be contended that the opportunity to patent an invention is all the encouragement to the promotion of the useful arts that is required in the public interest, and that there should be no other reward for the origination of a new thought or of a new method or device than that given by a patent. Passing for a moment the point that only a small class of useful ideas are capable of receiving the benefit of letters-patent and referring only to things that are patentable, such a view does not seem to me fair or reasonable. Why should a man be forced, against his will, to publish what is in his mind?

The whole law of patents implies the right of a man to keep as a secret that industrial improvement which he has conceived. It is because that right is recognized that patent laws exist. They say in effect: "You, the inventor, have a trade secret which is, among other things, new, useful and the result of invention. You may keep this secret if you can, and so long as it is kept secret you and those claiming under you alone may use it. If your secret is discovered without breach of faith, as may be the case at any moment, you lose it absolutely. Do you not prefer to make a contract under the patent law by the terms of which you are to publish your invention in the best form known to you, and in consideration of that publication secure a right, which you can not otherwise have, and which shall be enforceable by law, to prevent the use of your new idea by any others without your consent for a limited term, say seventeen years?" You will, to be sure, sacrifice the chance you now have of keeping your invention for an indefinite time a secret and, therefore, in your own control, but in return you get the right to invoke the aid of the law to restrain any use without your consent for a certain period. Which course do you think most for your advantage?

As I understand the decisions, even unfairness or want of faith on the part of one who receives knowledge of the secret in confidence, does not make it impossible for him, before he is enjoined by the courts, to disseminate the information so that those who get it from him may use it freely. A person who has notice of the incapacity of his informant to violate confidence, or one who has given no consideration for the information, would be subject to injunction. On the other

hand, a *bona fide* purchaser of the secret who had no notice of any breach of confidence or of contract on the part of the one who sold him the information for value, could, I believe, use the information without interference from the courts. He, as a *bona fide* purchaser for value and without notice would have an equity equal to that of the possessor of the secret. Under such circumstances the courts are not likely to interfere.

If a disclosure was wrongfully made in trade journals or otherwise, it would be a difficult, almost an impossible, task for the one whose rights had been violated to secure redress against the entire public who had read of the secret and who were actually innocent of any breach of faith. Moreover, where there is a trade secret, the fact that it exists is likely to be known throughout the trade, and each competitor has the full right to find the secret for himself, using all information as to its nature and the results from it that he can get from an inspection of the product, from speculation, or in any fair way. I will say nothing as to unfair ways that might be employed and which might be carried out with effect, but so shrewdly as to evade the law. No man would prefer a trade secret to a patent if the only question was one between the chance of keeping his device or method to himself indefinitely without publication, and publication with a reasonable certainty of protection during a limited term. But the issue does not come up in this simple fashion.

In the first place, many trade secrets are not of a patentable character. Many such should surely be capable of protection in some way. There is no other possible way than through the present rules of law to which I have referred.

There are many valid reasons why the discoverer of a new industrial process may well determine not merely that it is for his interest to take his chances of keeping it secret rather than to publish it in a patent, but that the latter course might lead to disaster. While it is generally, but not always, easy to prove an act of infringement of a patent, on a product or a tool or a machine, it is often practically impossible to obtain legal proof of the process employed by one who is believed to infringe a process patent. The infringer is very apt to be able to keep his infringement an undiscoverable secret. I am inclined to the belief that a substantial part of the important and valuable trade secrets now in use, would, if patented, be used without much, if any, chances of redress on the part of the patent owner. At any rate, if the one who controls the secret fears that he could not prove infringement of a patent, is it contrary to public policy that he should be allowed to take his chances of keeping what he has discovered a trade secret rather than run the risk of losing it altogether by publishing it?

Again, nothing can be patented unless it involves invention. Pages have been written by way of defining invention. Many of our greatest judges have given all possible thought to the subject. It is still indefinite, however.

Inasmuch as a trade secret is a man's own, to use or not as he pleases, can it be required that he should absolutely give up his opportunity to utilize his idea for his own benefit, and incidentally for the benefit of the public, in his own factory and under the seal of secrecy, and take a patent which might be declared invalid for want of invention, no matter how useful and meritorious the subject matter might be?

It is to me somewhat significant that the legislatures of England and America, which have many times dealt with the patent law, have never directly touched the subject of trade secrets. They seem to have recognized the fairness and justice of the common law rules on the subject, and that the only course which would commend itself to a sound public sentiment was to make the patent laws so attractive as to induce the owners of patentable trade secrets to publish them in consideration of the patent grant. In this way they have to a large extent succeeded. There are an innumerable number of patents, and a comparatively small number of trade secrets. It is only in a few special classes of subject matter that the patent is not a more attractive reward for the new contribution to industrial progress than is the limited protection given by the law to a trade secret. It is only with processes which are practised in a factory and which are not disclosed by a study of the product that there is any substantial chance of maintaining secrecy.

If a man elects in those few cases not to publish but to take his chances, can there be any real objection to his pursuing that course? It is certainly inconvenient and annoying to some extent. It is a real personal hardship that a workman or engineer who has learned the secret under such conditions that he must respect it, can not utilize it in his subsequent work. It undoubtedly holds back the progress of the useful arts to some extent that the whole world is not free to practice it and to improve upon it. But this, in theory, is equally true as to things that are patented, during the long term of seventeen years in which no improvement on the thing patented can be rightfully used except by the patentee or those claiming under him.

On the other hand, I believe that sound business generally and the comparatively few arts in which such secrets are of any importance are definitely promoted by the fact that the law aids in preventing disclosures based upon bad faith.

Such are my views as to the ethics of trade secrets. They are those of the courts, and I believe of the public. I recognize that all industrial questions are now under investigation. Much good will come from a fresh study of them in their relations to modern social, political and economic conditions.

The question we have been considering is only one of many as to which the community has had settled views which were reflected in the unanimous findings of the courts. As to some of those questions, it may be that we are on the verge of marked changes of thought which may result in equally great modifications of what have seemed to be sound and permanent industrial and business principles, and in the applications of those principles. The engineers of the United States will surely be on the right side of the discussions of these subjects, and of any political or judicial action which follows those discussions. It may be well in every case to consider the grounds for the doctrine that has prevailed before condemning it altogether. It will always be necessary to determine whether the criticism should not be directed to the applications of the doctrine, that is, to the special cases, rather than to the doctrine itself. In the matter of the trade secret, there may be hardship or even wrong in special cases. If so, let us find out how to deal with the subject so as to retain what is right and to eliminate what is wrong.

The important thing for us to determine is whether or not the prevailing views as exemplified in the decisions of the courts, are not fundamentally sound, based as they purport to be on principles of thought and action that are in harmony with elementary rules of public policy and good morals. If they are right they should be sustained. For myself, and speaking generally, I can not seen what fairer or more reasonable views could be advanced in their stead.

The Pueblo & Suburban Traction and Lighting Company's Hydroelectric Plant.

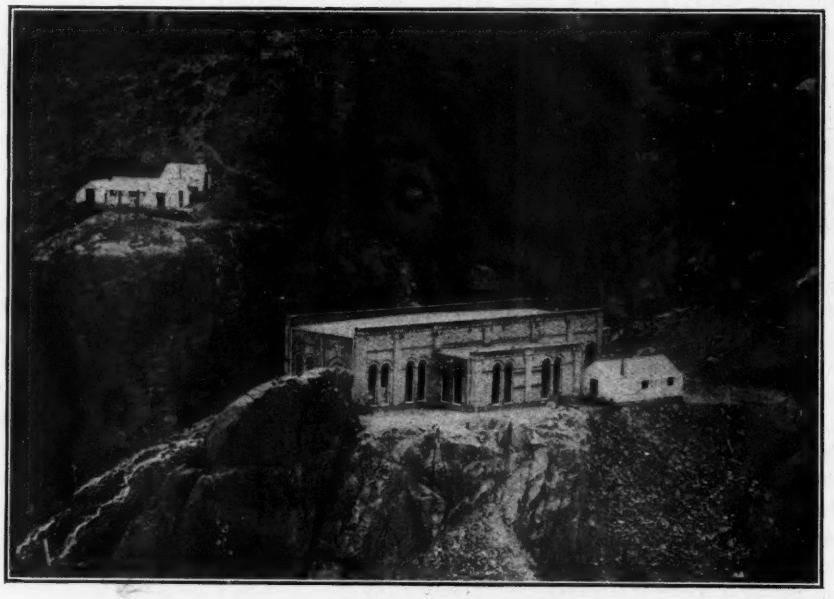
THE Pueblo & Suburban Traction and Lighting Company owns and operates a hydroelectric plant of some unusual features. This plant and hydraulic development was commenced and put into operation by the Pike's Peak Power Company, which was organized in 1899 by the Woods Investment Company, of Victor, Col. The construction was in charge of R. M. Jones as chief engineer. On December 1, 1902, in order to obtain a larger market and other advantages, a consolidation was effected with the Pueblo Traction and Lighting Company, the new corporation being called "The Pueblo & Suburban Traction and Lighting Company," and has since been operated under the direction of John F. Vail, general manager. By this arrangement, two markets are supplied by the plant, one being the Cripple Creek mining district, at a distance of ten miles, and the city of Pueblo, at a distance of thirty-five miles from the plant. The power plant is located nearly on a line drawn between the two markets.

The company acquired, by purchase, ranch property, placer claims and reservoir sites on West and East Beaver creeks, and also located, developed and patented placer claims along these streams and has, together with water rights, acquired by patent, the land along these streams for a distance of eighteen miles on the Beavers. These streams are noted for excessive differences in elevation in short distances and flow sufficient water to make them valuable water power properties.

One of the power stations contemplated by the company is completed and has been in operation nearly four and one-half years, known as Station A. The completion of this station has also accomplished much of the developments of Stations B and C by way of reservoir capacity and pipe-line delivery of water, which is especially serviceable to the two lower stations after being used through Station A.

DAM AND RESERVOIR.

The dam and reservoir are located five and one-half miles east of Victor. Here is constructed a large steel-faced, granite back-filled dam. The reservoir site consists of flat meadows, the lower end of which narrows to a deep canon. The bottom plate in the dam is at an elevation of 9,009 feet above sea level, the spillway level is 9,081 feet and the top of the dam is at an elevation of 9,090, making a structure eighty-one feet in height, 405 feet along the cap, 220 feet length of base, 148 feet cross-section of base and twenty feet cross-section of cap. The upper slope (being the steel face) is thirty degrees from the vertical and the lower slope is fifty degrees from the vertical. The spillway is sixty feet wide, cut in granite formation, and passes around the northwest end of the dam. The granite backfill, to which the steel plate is laid, is carefully laid in "dry wall" of heavy granite boulders, usually of twenty to eighty cubic feet each, was broken by heavy blasting, with loose, fine granite filling the intervening space.



POWER-HOUSE OF THE PUEBLO & SUBURBAN TRACTION AND LIGHTING COMPANY.

The steel plate is built up of sheets, five by fifteen feet, one-half inch in thickness for the bottom, eight plates in height. Continuing, the plate is reduced in thickness to three-eighths of an inch to top of the eleventh plate, and finally at the cap it is one-fourth of an inch in thickness. The entire sheet is riveted up with horizontal butt straps, and four by five by one-half-inch angle bars, placed vertically the entire height of the dam across each interval of fifteen feet across the entire length of the dam. The five-inch leg of each pair of angle bars projects into the reservoir and constitutes a standing joint seam, with an iron liner three-eighths by two inches, riveted between the extreme outer points of these angle bars, thus making a thorough expansion joint for each section of fifteen feet. The bottom and end connection of the entire sheet is concreted into a deep channel way, quarried out of bed-rock; the bottom terminates in two pairs of five by eight-inch angle bars, which are riveted through the plates. The end connections are prepared in exactly the same manner, but are applied vertically. The quarrying of the bed-rock channels was carried out horizontally in each case to a point rising to an elevation, and thence the rise was made abruptly in terrace form. The entire sheet is riveted up and calked in the same thorough manner as in boiler practice. A space of six inches was left between the steel plates and smooth surface of the granite backfill. This narrow space is taken up by sand, gravel and sedimentary deposit, the filling being applied with ample water and permitted to dry before water pressure was allowed to enter the reservoir.

The steel sheet is anchored securely to the face of the granite wall by means of one-half by six-inch steel cable, connected to the expansion joints by means of riveted loops, and the cables secured into the granite fill by means of railroad iron passing through loops in the cables, and embedded into the granite some thirty feet from the steel face.

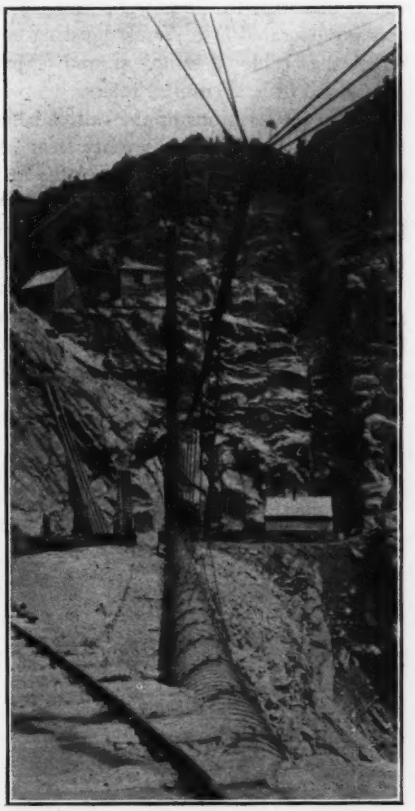
The reservoir has a surface area of 140 acres. The banks or walls are steep, as indicated by the contents capacity of the reservoir, which is 103,000,000 cubic feet at its sixteenth plate (being 9,081 feet elevation). Its capacity is 143,000,000

cubic feet at the top, at 9,090 elevation. The entire basin forming the reservoir is tight granite formation. The area of the watershed draining into this reservoir, being the total south and southwest slopes of Pike's Peak, is seventy square miles, nine square miles of this drainage being partly taken up by some small reservoirs, sixty-one square miles being controlled entirely and nine miles partly by unquestioned prior rights.

In the building of this dam, as there were no rock quarries or loose deposits of rock in the vicinity of the site for the dam, it devolved upon Mr. Jones to devise a way to procure a sufficient quantity from solid formation. Specifications at that time called for 42,000 yards.

About 600 feet east of the dam site and at an elevation of 300 feet above the top of the dam was a round knoll or butte. This butte was of solid granite formation and at an elevation of sixty-five feet below the apex a contour line was run and the portion above this line was found to contain 110,000 cubic yards. It was decided to break the entire 110,000 yards at once.

A tunnel was driven to the centre of the butte at the elevation of the contour line, a distance of 131 feet. At the end of the tunnel drifts were driven each way, a distance of thirty-five feet, forming a T-shaped working. In the tunnel and drifts five-foot holes were drilled to be used as firing holes. The firing holes were loaded with six pounds each of giant powder and connected with three separate and independent circuits of electric exploders. In the drifts and tunnel were placed 30,000 pounds of black powder, the drifts containing 27,000 pounds and the tunnel 3,000 pounds. In addition to the three sets of electric exploders used, several lines of fuse were run through the tunnel to avoid any chance of miss fire. A point 3,000 feet distant and somewhat higher than the butte was chosen for a firing station. The effect was instantaneous and marvelous. There was no report. Only a rumbling sound was heard. The top of the butte seemed to open up and burst and settle back, leaving a black volcanic-looking crater in the centre.



PUEBLO & SUBURBAN TRACTION AND LIGHTING COMPANY — RELIEF STAND-PIPE AND PIPE EMERGING FROM TUNNEL.

Subsequently, a narrow gauge railway was constructed from the dam to the crater through a cut at a thirty-eight per cent grade. Two ordinary flat cars were used on this railroad, one being loaded in the crater while the other was being unloaded on the rock fill composing the dam. The cars were connected by a one-inch cable which ran around a brake drum in the quarry and were operated by gravity.

WOOD AND STEEL PIPE-LINE.

Water is taken into the wood-stave pipe through a grizzly 240 feet long, perforated by means of slots one-quarter-inch wide, eighteen inches long, sawed in wood staves, giving thirty times greater area than the pipe. This pipe grizzly is anchored firmly on a raised rock foundation. The connection between the grizzly, also the main pipe-line, is connected to the steel facing of dam by steel single connections.

The wood pipe is 23,200 feet long, thirty inches inside diameter, and is of one and one-half-inch redwood staves, banded with one-half-inch steel bands and cast-iron lugs. The bands are spaced at intervals along the pipe at various distances between two and one-half-inch and eight-inch centres as necessary for resisting the internal pressure, variations in spacing being caused by various inverted syphons along the line, two of which reach 215 feet head. This pipe-line extends over fearfully rough country, about half of the grade being through original granite formation; many curves are less than 100 feet radius and one compound curve is thirty-five feet. The wood pipe passes through the Skaguay tunnel, which is 1,533 feet in length, located at 20,000 feet from dam. The tunnel was all solid granite, requiring no timbering.

At a point on the pipe-line, 22,600 feet

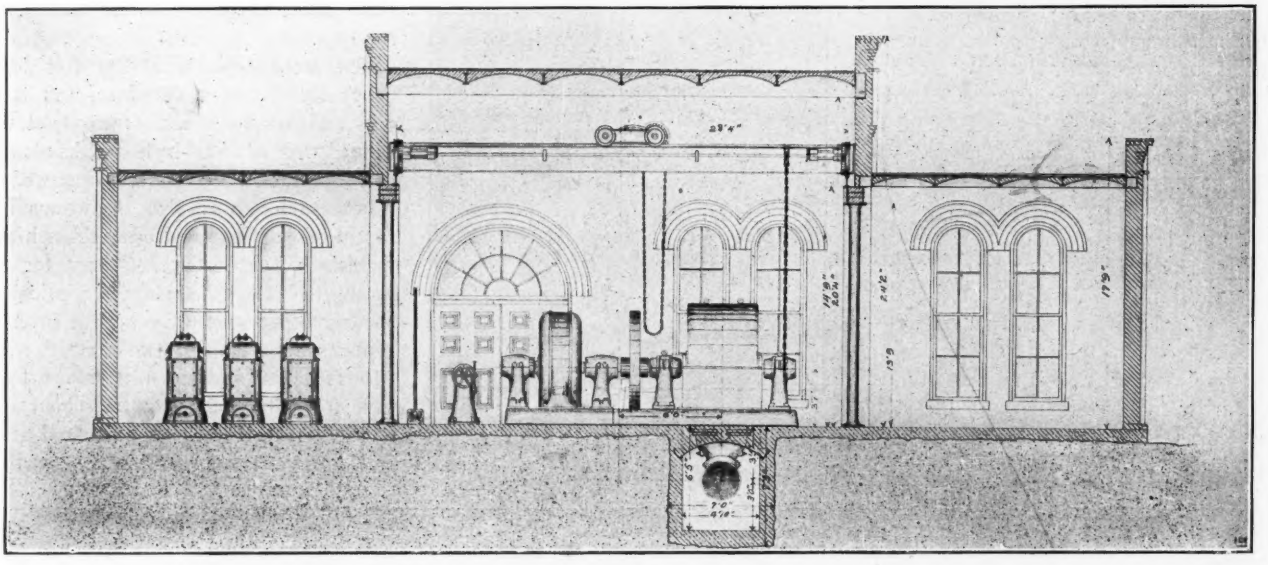
PUEBLO & SUBURBAN TRACTION AND LIGHTING COMPANY—DAM IN PROCESS OF CONSTRUCTION, AND VIEW OF PIPE-LINE.

from the dam, and at the highest elevation of the pipe after the first 1,600 feet, located directly at the south end of Skaguay tunnel, is located a tee of steel plate, five-sixteenths-inch in thickness, from which a "riser" is extended vertically seventy-three feet. This riser is the same as the wood-stave pipe, thirty inches inside diameter, and its open top end is three feet higher than the sixteenth plate at the dam. This riser prevents the water ram from increasing pressure in any part of the pipe. Immediately below the riser, and in the same concrete enclosure, is a thirty-inch gate valve for closing in case of emergency. There is also a thirty-inch gate valve in the pipe at the dam.

From a point 300 feet below the Skaguay tunnel, where the static head is 120 feet, the line consists of steel pipe twenty-nine inches in diameter, in various thicknesses of plates, ranging from one-quarter to three-quarters of an inch, as required to meet the internal pressure with an ample factor of safety.

The total length of steel pipe, including the reservoir, is 2,900 feet, and on an incline varying from twelve-and-one-half per cent to fifty-seven per cent. It passes over grades constructed through very tough granite, at one point passing through an inclined tunnel, 335 feet in length, just above which is a bridge seventy feet in height, both being on forty per cent gradient, and at various points there are extremely deep open cuts. From the south end of the Skaguay tunnel the pipe-line is entrenched in the grade on which is constructed a three-foot-gauge railway leading from the Skaguay tunnel to the power-house, its grade being 1,165 feet vertical in 3,100 feet horizontal. The track curves continually and grades vary from twelve and one-half per cent to fifty-seven per cent. This road is the only means of access to the power-house. The cars are operated by a double hoisting engine, the cable passing around gipsy rollers and over horizontal idlers.

The upper terminus of the railroad lies under a vertical ledge seventy feet in height, and all machinery, apparatus and materials of all kinds were lowered by boom and derrick, taking loads from the wagon at the upper landing and lowering them seventy feet over the ledge to the cars, from which point the loads were lowered by a friction brake on the hoist, equipped with a three-quarter-inch steel cable. One thousand four hundred tons of building materials passed down this railroad. A horse trail has recently been completed between the dam and station A.



Pueblo & Suburban Traction and Lighting Company—Front Elevation of Power Station A.

STATION A.

The power-house, Station A, has dimensions thirty-eight by 100 feet, with two side wings sixteen by forty-eight feet each, and is located on the summit of a granite projection surfaced off true to grade. The building is constructed of brick, with steel corrugated arched roof, concrete, tar and gravel-covered, concrete floor, and is absolutely fireproof. The building is provided with a ten-ton traveling crane.

The hydraulic apparatus was manufactured by the Pelton Water Wheel Company, of San Francisco. Each unit consists of two steel disc wheels, sixty-six inches in diameter, keyed on the same shaft and working in the same wheel-house. The base frames are built-up box patterns of the same type and general design as the generators, to which they are connected. The frames of the water-wheels and generators are faced for accurate, rigid connection to each other by bolts and dowels. The connection of water-wheel and generator shafts is effected by a 7,000-pound steel cast balance wheel, banded with a rolled-steel tire, four inches in thickness. The wheel is seven feet in diameter, and its hub forms the connection on the water-wheel shaft. One-half of the hub forms the other half of the "face coupling," which is keyed to the shaft of the revolving field, forming an accurate and rigid direct connection of the shafts of the two machines. The total static head on the nozzles is 1,152 feet, or approximately 500 pounds per square inch. The nozzles used, as applied under 1,152 feet effective head, require a diameter of one inch to produce 138 horse-power, including losses.

The nozzles for each unit vary in diameter, one having the capacity of the generator and the corresponding nozzles for the other wheel in the same unit, being somewhat reduced. Each wheel in each unit will produce power for the full capacity of the generator connected. In operation, however, it is customary to install such varied diameter or capacity of nozzles as to permit the operation of the full capacity of the load demand from time to time by the operation of nozzles under full pressure, and but slight loss

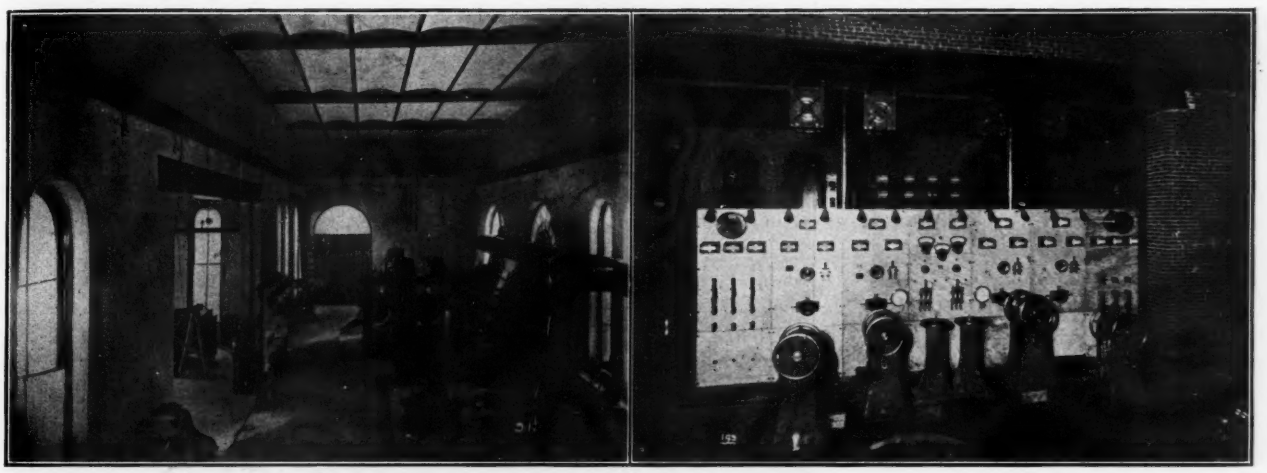
in water due to the regulation for low loads.

The nozzles are of the deflecting type and work under full pressure at all times. The regulation is of the Armstrong type, as it was believed that automatic regulation under existing conditions would be a failure. The present management has, however, installed two Sturgess governors on two units which govern by deflecting the nozzles. Pelton needle nozzles were also installed which are opened and closed by hand. These are working very satisfactorily. Due provision has been taken to extend the actual control and regulation of each unit to a point directly in front of the switchboard panel belonging to that unit. The receiver runs longitudinally through the building under the steel-concrete floor. The discharge or tail-race water returns directly under the receiver to the south or lower end of the building, at which point it will later unite with water conducted from a point 800 feet above Station A, where a catcher-dam is to be constructed, and the water diverted from the Beaver stream channel, there being considerable accumulation of water between the dam and Station A, and with the accumulation in the stream, the combined waters will be conducted through a pipe-line two and three-quarters miles to a point 200 feet above the forks of the East and West Beaver creeks, at which point is to be constructed Station B. There will also be built a smaller pipe-line up the east fork of Beaver to the same static level as the tail-race water of Station A. The waters of both pipe-lines will be united before entering the receiver. The pressure at Station B will be 1,252 feet or 543 pounds pressure per square inch. With the added accumulation of water in the West Beaver branch, 3,500 horse-power will be obtained, and from the East Beaver branch about 2,000 horse-power, or a total of 5,500 horse-power, all of which may be developed at Station B.

ELECTRICAL EQUIPMENT.

The electrical generators in Station A consist of four 400-kilowatt General Electric machines, three-phase, thirty cycles, 600 volts, with stationary armatures and revolving fields making 450 revolutions per minute, direct-connected to the water-wheels, and two 200-kilowatt compensated three-phase generators, sixty cycles, also connected direct to the water-wheels. These generators are twelve-pole and operate at 600 revolutions per minute, and each machine contains its own exciter built directly upon the revolving field shaft. The sixty-cycle machines are required to supply current for arc lighting in the Cripple Creek district. Since the power load at the mines consists entirely of thirty-cycle motors, which were supplied by companies already in the field there was no alternative but to adopt thirty-cycle apparatus for all power service. Hence the two frequencies are generated and transmitted. The exciters consist of two seventy-volt, direct-current generators, direct-connected to Pelton wheels running 675 revolutions per minute. Each machine has sufficient capacity for all four generators while working at full load.

The switchboard apparatus is made up of two exciting-current panels, six generator panels, two distributing panels and two high-tension panels. There are two sets of bus-bars running the length of the switchboard, one being used for thirty-cycle and the other for sixty-cycle current. Each panel is made of Vermont marble, sixty-two by thirty-six inches, with sub-bases twenty-eight by thirty-six inches, two inches in thickness, with a complete equipment of indicating and recording instruments, switches and regulating apparatus. The main-line switches from each machine are operated independently and are double-throw to connect with either set of bus-bars. The circuits are arranged so that any or all the machines may be applied on either circuit. The machines operate nicely in parallel. For the Victor transmission six 250-kilowatt air-blast step-up transformers are installed for 600 volts on the primaries and 12,600 volts on the secondaries. The transmission line consists of two circuits and two or three transformers are connected in delta to each circuit. For the Pueblo end seven 200-kilowatt oil-insulated air-cooled transformers are connected, three each to the double circuit line as for Victor, leaving one for reserve. These transformers are built to step-up to 24,000 volts when connected in the delta and to 41,500 volts connected in the Y. At present they are operated on the delta connection. The General Electric multigap standard lightning arresters are connected on each outgoing circuit.



PUEBLO & SUBURBAN TRACTION AND LIGHTING COMPANY—INTERIOR OF POWER-HOUSE, AND VIEW OF SWITCHBOARD.

All electric apparatus in the station was supplied by the General Electric Company.

TRANSMISSION LINES.

The line transmission from Station A to the Victor substation, which is the centre of distribution for the Cripple Creek district, is eight miles long. The circuits consist of three power wires of No. 4 Brown & Sharpe and three wires of No. 6 Brown & Sharpe gauge medium-hard-drawn bare copper. These lines are transposed at intervals of each half mile along the line. The poles also carry a telephone line consisting of two No. 10 gal-

vanized-iron weather-proof wires, which are transposed between every pole. This is accomplished by keeping one wire drawn tight and the lower wire slack, both being fastened to a short cross-arm on the pole and crossed in the middle of the span. This method of transposition is easily made and if there are no grounds upon the telephone or line wires there is very little induction, and conversation between Victor and Pueblo, a distance of forty-five miles, is perfect.

The insulators on the Victor line are made of porcelain, five and one-half inches in diameter, and each is made up of three independent cups. They were supplied by R. Thomas & Sons Company. The pins are extra long, wooden, with one and three-quarters-inch shank. The poles are of Idaho cedar, thirty-five to sixty feet in length and nine to twelve-inch tops. A grounded guard wire is strung along the tops on small glass insulators. General Electric lightning arresters are installed upon the pole line about one-half mile from either end.

The transmission line to Pueblo, thirty-five miles long, consists of two circuits, six wires, consisting of No. 4 Brown & Sharpe bare copper, hard-drawn. Through the city limit weather-proof insulation is used. The poles are of Idaho cedar, thirty-five to sixty feet long, with nine to twelve-inch tops. Locke insulators are used, designed for a working voltage of 40,000 and are of glass, ten inches in diameter, made of two pieces cemented together in the field and cemented to steel pins. The later insulators being installed are three-piece porcelain and fourteen inches in diameter. The wires are arranged in the form of equilateral triangles with apex at the top.

General Electric multigap style of lightning arresters are installed in a wooden house about one-half mile from the terminals of the line.

DISTRIBUTION.

The Victor substation is constructed of brick, steel and concrete and the 12,000-volt transmission circuits enter this building. For local lighting in Victor the current is transformed to a 115-200-volt secondary connected in the "Y" four-wire system. The town being compact, distribution for lighting is made at this voltage. There is also a set of three fifty-kilowatt oil transformers of 12,000 to 350 volts which operates a 120-kilowatt rotary converter, which operates in turn a locomotive in the United Mines Transportation tunnel, for ore haulage from the first level of the Gold Coin mine to the Economic mill.

High-pressure distributing lines leave the substation in various directions after passing through 20,000-volt oil switches, making each line independent, to twelve transformer stations situated in the mining district. These transformer houses are situated close to the larger motors and reduce the voltage to 460 volts for 440-volt induction motors. Secondary lines radiate from these transformers to smaller motors, electric hoists, etc., and also distribute current for lighting the smaller towns and isolated mines and houses. Transformers are used for the latter service with a ratio of 460 to 115 volts. There are, in addition to the two main towns of Cripple Creek and Victor, seven smaller towns situated in the mining district. There are also two large steam plants which supply power and light in competition with this plant. About eighty-five per cent of the current supplied by this company is sold by meter. The remaining fifteen per cent is sold at a flat rate for operating small motors and electric hoists.

All distribution districts and towns are also reached by series-alternating arc lines operated from the Victor substation by means of sixty-cycle constant-current transformers with a primary winding of 12,000 volts. There are five cyanide mills connected, each using motors ranging from 100 horse-power to five horse-power. Many of the larger mines are also installing electric motors and throwing out steam equipment for operating compressors, small hoists and steam auxiliaries.

At the Pueblo end of the transmission line the current is brought into a brick and steel transformer house and reduced to 2,200 volts for motor-generator sets and to 350 volts for rotary converters. Six 200-kilowatt oil-insulated air-cooled General Electric transformers are installed and protected by multiplex-type arresters. The current is transformed by two motor-generator sets of 300 kilowatts each to sixty-cycle, 2,200 volt, three-phase, for lighting and by two rotary converters of 300 kilowatts each to 500-volt direct-current for street-car service. The company owns and operates the street-car lines and supplies all city and commercial lighting for the city of Pueblo. The transformers at either end of the Pueblo transmission line are built to operate at 40,000 volts when connected in the "Y." At present they are operated at 24,000 volts and connected in the delta. The rotary converters are operated in parallel on the direct-current side with the steam railway generators when desired, and a large storage battery is operated from the direct-current bus-bars in conjunction with a booster which materially assists the water governors at Station A.

PUEBLO & SUBURBAN TRACTION AND LIGHTING COMPANY—FIRST TRANSMISSION POLE.

Northwestern Electrical Association.

Report of the Fifteenth Annual Convention, Held at the Coliseum Building, Chicago, January 16, 17 and 18.

THE fifteenth annual convention of the Northwestern Electrical Association was called to order by the president, Harold Almert, of Chicago, January 16, at 11 A. M., in the Coliseum Building, Chicago.

After welcoming the members of the association to Chicago, President Almert in an informal address directed attention to a number of matters of interest. The craze for municipal ownership of public utilities seems to be dying down and but little legislation adverse to electrical interests has been enacted. Many small electrical companies have revised their methods of conducting business and are now beginning to prosper, with a resulting beneficial effect to such securities. The prevailing prices for materials are retarding new construction, so that most of the new business is secured in districts already served. The work of the secretary has put the association on a much better business basis and hereafter bills for dues will be sent out simultaneously to all members. A revision of the constitution seems desirable.

Secretary B. C. Adams presented a brief report and the session was adjourned until 2 P. M.

At the afternoon session several papers were taken up, the first being entitled "Warrantable Expense for Meter Testing," by O. J. Bushnell, of the Chicago Edison Company. This urges the advisability of periodic testing and suggests that small meters be tested annually, meters for from fifteen to fifty amperes semi-annually and meters for seventy-five amperes and over every three months. Cupped diamonds have been found valuable for maintaining the accuracy of meters. They last at least five times as long as sapphires. A thorough system of testing can not be put in force for less than seventy cents per meter per year for induction meters and $1.50 for commutator meters. The Chicago Edison Company has effected a saving of 1.6 per cent of the stations' output since adopting a systematic method of testing. The question is, however, one of ethics as well as of economy and should therefore be given more attention.

F. W. Insull, Chicago, said his company made frequent test of its meters and found it paid. Moreover, it gives the company an advantage when replying to complaints. Old meters are sold and bring one or two dollars each.

A paper on "Profitable Cooperation" was read by J. Robert Crouse, Cleveland, Ohio. A plan was described involving an expenditure of $151,000 during 1907 and an outline of a larger scheme which would later call for an annual expenditure of $369,000 was given. The formation of a permanent organization is suggested, the employés of which are to devote their entire time to carrying out plans for increasing the sales of electricity and electrical apparatus.

Ernest Gonzenbach, Sheboygan, Wis., presented a paper entitled "Electrical Possibilities of Wisconsin Water Powers." There is a close analogy between the water power situation in Wisconsin to that prevailing in New England, though more power is available in Wisconsin. As yet but little development has been done because the lumber interests have regulated the flow of water to suit themselves. Now that the supplies of lumber are about exhausted the water powers will become available for power purposes. There are eight important rivers in Wisconsin, which were taken up severally and the power possibilities described. The Fox river is already well developed. The Menominee has a total fall of 500 feet but the power available is not sufficient to justify long-distance transmission. The Peshtigo and Oconto are two short rivers which have rapid falls and are capable of producing large quantities of power. The former has a fall of over 1,000 feet in 140 miles and the latter 945 feet in eighty-seven miles. Unfortunately, the storage facilities on both are poor. The Wolf river has a fall of 812 feet in 130 miles. It has been well developed. The Black river has a fall of 560 feet in 125 miles, but as the watershed is long and narrow, the flow of water is somewhat unreliable for electrical purposes. The Chippewa has a fall of 750 feet in 178 miles and is one of the most valuable. Its sources lie in thousands of small lakes. The flow is reliable and there are available good natural sites for dams. The Wisconsin river has a large drainage area and there are good facilities for storage. It has a fall of 1,046 feet in 429 miles. The possibilities for development are great.

The northern part of Wisconsin has an annual rainfall of forty-four inches, for which the swamps and lakes offer ample storage. The minimum run-off of the Wisconsin rivers is four-tenths of a cubic foot per second for each square mile of drainage area. This is unusually high. With adequate storage this could be raised to about nine-tenths second-foot.

The money which would be required to develop the Wisconsin water powers is small compared with many other undertakings. As soon as the state legislature has formulated the laws for regulating such industries this work will probably go forward.

L. P. Utley, Watertown, Wis., pointed out one problem in the hydroelectric development. The power company may have difficulty in acquiring the land needed, as it can not condemn land as may be done in certain other states. The electrical companies should make united effort to secure suitable legislative action in this matter.

At the Thursday morning session, F. W. Insull, of the North Shore Electric Company, Chicago, read a paper on "Uniform System of Accounting for Small Companies." This paper suggests methods which contain the essential features of the elaborate systems of accounting adopted by the larger companies, modified to suit the needs of the smaller companies. Such companies should keep a meter-reading record, a customers' ledger, a cash-book, a register of disbursements and a general ledger. Desirable forms were described and details of the methods of keeping the accounts were explained.

P. H. Korst, Janesville, Wis., said that in addition to being of value to the company, an adequate system of keeping accounts would be most beneficial in the event of state regulation of public utilities, which seems near. The state officers would then easily reach a clear understanding of the condition of the business.

H. H. Scott, of Henry L. Doherty & Company, New York, presented a paper on "Some Phases of Smaller Central Station Management." The good-will of the public should be cultivated and new business should be energetically solicited. The problem of producing electrical power is primarily one of investment and secondarily one of operation. That equipment should be installed which will produce the output necessary at the minimum total cost. Great care is necessary in designing new stations and in remodeling old ones to reach this end, and old equipment should be discarded only after careful consideration. It may often be used effect-

ively for carrying the winter load peaks. New apparatus should be of the best grades. The operation of the plant should be carefully studied. Load curves of the station and of each machine should be plotted to this end. It is not a good policy to install sufficient copper to carry an occasional peak if this may be taken care of by raising the voltage. The losses in transformers and meters should receive careful consideration. It is very important to use only accurate meters. Careful records of the station and comprehensive accounts should be kept.

W. B. Jackson, Madison, Wis., did not agree with the statement that production is primarily an investment problem. More depends upon the management, which, if good, may make a bad plant succeed. But no plant can be successful with bad management. Old apparatus should not be thrown out without careful scrutiny, yet when it has done its work it should be laid aside. The good-will of the public should be cultivated.

E. Gonzenbach said that heretofore many mistakes have been made by foolish condemnation of old apparatus which might have been used for carrying the load peaks. It is very important to maintain the good-will of the customers.

President Almert, while admitting the desirability of retaining old apparatus to take care of the peaks, insisted upon the necessity for scrapping it and purchasing the best apparatus obtainable for carrying the steady load of the station. It is advantageous to throw out the old apparatus, which gives several kinds of supply, and get down to a common generating basis. There may properly be more hesitation in discarding the old steam equipment.

J. H. Harding, La Porte, Ind., thinks much depends upon local conditions. High-frequency apparatus is more suitable for his locality, and he thinks that the movement started four years ago to secure the adoption of a uniform frequency has not been beneficial in all cases.

O. M. Rau, Milwaukee, said the station equipment should be that which gives the lowest operating cost.

Mr. Scott, in reply, said that the cost of the old apparatus should be charged against the new equipment, and if this is done often a new equipment will make a poor showing. He maintained that the problem is primarily one of investment, as the investment cost and interest should be reduced to a kilowatt basis and then compared with the operating cost. Nothing tends to reduce operating cost as much as new business. He urged the adoption of a standard size of meter for residence use. They will stand heavy overloads for short periods. A five-ampere meter is satisfactory for most purposes.

A paper presented by H. Honeywell on the "Utilization of Lighting" was read by W. B. Johnson. It describes the business secured by the Lincoln Gas and Electric Light Company, Lincoln, Neb., by lighting signs and show windows. The solicitors are paid a salary and a graded commission on the business secured. Personal solicitors, newspaper and mail advertising are used. The cost for the past three years has been forty-three cents for each dollar of increased revenue. Sales of current have increased sixty per cent in this time, while the peak load has increased twenty-three per cent. The sales during the past year were 689 kilowatt-hours for each kilowatt of plant connected.

C. A. Parker, Detroit, commented upon the tendency to revert to the flat rate in sign and window lighting.

Mr. Insull said the flat rate was attractive for securing such business.

President Almert said he had not found time-switch business very satisfactory, but he has received reports from central stations showing good results.

John S. Allen, Lake Geneva, Wis., has adopted the plan of letting consumers turn on the window lights and arranging with the night policeman to turn them off. He has had but little trouble with the users.

W. B. Johnson said it was desirable to have merchants purchase signs. They take pride in them and are less likely to discontinue the service. Window lighting is very effective and popular with merchants.

C. A. Parker said the flat rate is advantageous to the small station, as it brings in a constant revenue the year around.

President Almert opened a discussion on producer-gas plants by reading extracts from a report on "Recent Developments in Prime Movers." This discussed the progress made in steam-turbine construction and recent gas-engine practice. Figures were quoted to show the relative costs of power produced in various ways.

Thomas B. Whitted, of the Westinghouse Machine Company, St. Louis, pointed out the value of gas engines for carrying load peaks and mentioned plants which had adopted this practice. The labor for running a producer need be no more intelligent than that required to care for a boiler. The introduction of the producer plant had been retarded by several bad failures, but the effect of these is now being overcome.

President Almert described the fuel test now being conducted at St. Louis by the United States Geological Survey. He pointed out that the efficiency of the gas engine falls off considerably at light loads.

Mr. Whitted said the average gas engine requires from 11,000 to 12,000 British thermal units per horse-power-hour at full load; at three-quarters load it takes about 14,000, and at half-load about 16,000. Operating continuously at half load would still effect a considerable saving over other engines.

A recess was then taken for lunch.

At the afternoon session a paper was presented by C. W. Bergenthal, of the Wagner Electric Manufacturing Company, St. Louis, entitled "Some Characteristics of Alternating-Current Motors in Which the Central Station Man is Vitally Interested." One such characteristic is the starting current. This is much less with the coil-wound armatures than with the squirrel-cage, and the auto-starter does not reduce it much. The single-phase commutator motor has even greater advantages over the split-phase motor. Another important characteristic is the load capacity of the motors. Curves were shown illustrating this feaure and also those of efficiency and power-factor. The single-phase motor is generally used for small powers up to seven-and-a-half horse-power, but even in larger sizes it does not upset the regulation of the system.

O. M. Rau said in Milwaukee fifteen-horse-power single-phase motors are permitted in certain sections of the city, but a test is always made before installation to see if they will cause too great a disturbance. The single-phase motor has been as successful as the direct-current type. The elevator motors cause the greatest disturbance, as they are often in districts where the other load is light. The best way to overcome the trouble is to put in a larger transformer.

Mr. Bergenthal said the installation of the single-phase variable-speed Wagner motor has so far been limited to driving printing presses. The speed is controlled by an auto-transformer or armature resistance. The change in speed does not affect the voltages of the system much. Motors for frequencies over sixty cycles have a somewhat lower efficiency, about ten per cent, but are otherwise similar to the low-frequency motors.

The meeting was then addressed by Mr. Watrous, of the Citizens' Business League

of Milwaukee, who urged that the next meeting be held in that city.

A paper was read by J. R. Cravath, of Chicago, entitled "Some Points on Illuminating Engineering for the Small Central Station." This called attention to the necessity for shading lamps and for directing the light properly. Avoid art-glass domes and discourage large chandeliers with small lamps. The new high-efficiency lamps should be frosted.

George Cutter, South Bend, Ind., said illuminating engineers, while doing good work in the study of the best methods of illumination, are neglecting the artistic side. He uses vertical lamps on brackets, surrounded by globes. A short ceiling fixture takes the place of the chandelier in the dining room. When desirable the shades have a light color. Fixtures are more or less of a necessary evil and should be made as small and unobtrusive as possible. The switching devices need more attention than they get now.

F. W. Willcox, Harrison, N. J., said the one difficulty most frequently met in getting satisfactory lighting is a deficiency in the number of outlets. If the illumination is uniform a much lower intensity gives satisfactory results. He urged the lighting companies to introduce the new lamps and take this opportunity to show what might be done by improved methods of illumination.

George Westover, Cadillac, Wis., pointed out the difficulties of adopting any standards of illumination, as much depends upon the local surroundings, the color of the walls, etc.

Mr. Cravath said the best way was to allow a certain number of watts per square foot and modify the figure thus obtained by allowing for the color of the surroundings. A little practice was all that was needed and the solicitors could easily give approximate estimates. He agreed with Mr. Cutter as to the objectionable features of fixtures. Bracket lamps should be pointed up, chandelier lamps down. Usually the ceiling is too brightly lighted. Portable lamps should not be allowed in the centre of the room.

Mr. Willcox called attention to the excellent lighting of Marshall Field's store, secured by means of many ceiling outlets. The illumination runs from two to three foot-candles with a consumption of about 1.25 to 1.4 watts per square foot, with ceilings ten feet high. With 2.5 watts per square foot from four to five foot-candles is obtained. The new arrangement takes the same amount of power as the old, which used chandeliers, but gives twice the effectiveness.

The session was then adjourned.

On Thursday evening the association held a joint session with the Chicago section of the Illuminating Engineering Society.

The first business at the Friday morning session was the election of new members, eighteen being admitted to the association.

Ernest Gonzenbach described recent work done by the Sheboygan Light, Power and Railway Company, in a paper entitled "Premiums to Employés." The average annual cost of coal, oil and ordinary repairs was determined and reduced to a kilowatt-hour basis. The employés were told that they would be given a certain percentage of any reduction in this item that they could bring about. This premium is distributed monthly and is charged as station labor. It amounts to a considerable addition to the wages of the men, but has brought about a corresponding saving in the cost of supplies. The plan also weeds out the poorer men.

The company then organized a new-business board, consisting of all the employés who come in contact with consumers. The members of this board get ten per cent of the increase in revenue over the corresponding month of the preceding year. During a year's trial the average monthly increase has been about sixteen per cent. Moreover, the employés take more interest in the welfare of the company and the consumers, and this has improved the feeling of the public toward the company.

A number of high-school boys have been enrolled who report any dissatisfaction they may learn in return for a certain number of street-car tickets. This system is thought to be responsible for an increase in current consumption among consumers already connected. The boys also get a bonus for every new customer they bring in, and on all apparatus they help in selling. A considerable addition to the revenue comes from flat-irons, which are sold at cost.

President Almert said a way should be devised to provide a more uniform premium for the station employés throughout the year. By the plan outlined the premium in summer would be small, although the men worked just as hard. The plan also offered inducement to the men to falsify their records.

Mr. Gonzenbach said all records are checked by monthly inventories and dishonest men discharged.

A paper was presented by A. Bement on "Tendencies in Design of Boiler Plants." It points out the necessity of providing ample heating surface and of designing the furnace to prevent leakage and the advantages of baffle plates. An ample combustion chamber is necessary and the feed of the coal should be as nearly uniform as possible.

A written discussion of this paper was presented by William Bradford, Lincoln, Neb. The writer did not agree with Mr. Bement that small boilers are more economical than large, if the proper proportions are adopted and care be taken in the setting. Some improvement in boilers already installed may be made by controlling the path of the gases. There is more opportunity for this when mechanical draft is employed. The character of the fuel must be considered in designing the setting. Mechanical stokers are often valuable in small plants. Gas-testing apparatus is useful in checking the combustion, and the automatic damper-regulator also increases the efficiency, as do other automatic appliances.

Mr. Bement said the carbon-dioxide meters are reliable, but he does not think they are necessary, probably because he has had much personal experience with boilers. By studying the performance of the stoker one can learn to tell what it is doing at any time.

The election of officers then took place, with the following result:

President: Edward Daniel, Marinette and Menominee, Wis.

First vice-president: B. C. Adams, Lincoln, Neb.

Second vice-president: H. F. Pearce, Negaunee, Mich.

Secretary-treasurer: R. U. Kimball, Kenosha, Wis.

Directors: J. S. Allen, Lake Geneva, Wis.; W. P. Putnam, Red Wing, Minn., and G. H. Lukes, Chicago, Ill.

A motion was passed to have a handsomely bound copy of the transactions prepared and presented to the retiring secretary, B. C. Adams, who had refused any remuneration for his services, although there is a salary attached to the position.

It was decided to hold the next convention in Milwaukee, and the meeting was then finally adjourned.

Long Acre Light and Power Company Gets Favorable Decision in Appellate Court.

Under a decision rendered Friday, January 18, by the Appellate Division of the Supreme Court, New York city, the Long Acre Light and Power Company, which was organized in 1903 to generate and sell electricity for lighting, heating and power purposes, can compel the Consolidated Telegraph and Electric Subway Company to permit the Long Acre company to lay its wires and conductors in the Consolidated company's conduits.

The Chicago Electrical Show.

Second Annual Exhibition of the Electrical Trades Exposition Company, Coliseum, Chicago, Ill., January 14-26, a Great Success.

ALTHOUGH hampered in several directions, the management and exhibitors of the second annual electrical show, held at the Coliseum, Chicago, Ill., January 14-26, under the auspices of the Electrical Trades Exposition Company, celebrated the opening on Monday, January 14, in very effective style. The huge exhibit space was well filled with booths, making a remarkable display of light and color, to say nothing of the great variety of apparatus shown. A modeling of "Electra" surmounting the universe and a fifteen-foot dancing skeleton were among the spectacular attractions, and for the amusement of some there was an electrical midway, where W. J. Clarke demonstrated many of the effects of electrical phenomena, and where two electrical creations, "The Shipwreck" and "Aurora Borealis," were exhibited.

The manufacturers having exhibits were well represented by their executive and sales forces, and there was a large attendance, as visitors, of representative men from all parts of the country.

A remarkable feature of the show was the very great interest which the public manifested in its attractions. This interest was well maintained throughout the entire two weeks. The demonstration of electric heating and cooking were especially appreciated, and, in fact, every application of the electrical devices, from a curling-iron heater to driving a sewing-machine or clothes-wringer or dough-mixer, was watched by an intelligent and thoroughly interested crowd of visitors.

The Chicago Edison Company and the Commonwealth Electric Company made their usual magnificent display of applications of electricity for light, heat and power. This exhibit was educational in every feature. Demonstrations of heating and cooking apparatus attracted large crowds, and kept the attendants busy supplying the demand for hot biscuits, waffles and coffee, along with several forms of pastry and sugar confections. At one end of this exhibit a well-equipped mechanical department printed daily is-

GENERAL VIEW OF THE SECOND ANNUAL ELECTRICAL SHOW, HELD BY THE ELECTRICAL TRADES EXPOSITION COMPANY, COLISEUM, CHICAGO, ILL., JANUARY 14-26.

sues of *The Electric City,* the printing press, binder and cutting machine all being motor-driven.

The North Shore Electric Company also exhibited many applications of electricity for domestic purposes in a very attractively decorated booth and served hot coffee and biscuits to the visitors.

The Chicago Telephone Company and the American Telephone and Telegraph Company made a joint exhibit, covering a goodly amount of floor space and affording the visitor an opportunity of resting while listening to the explanations of the demonstrators, who delivered impromptu lectures on the different phases of traffic and exchange operation. A ten-position multiple board was shown in full operation, the operators making the cord connection while the demonstrators explained each operation. The American Telephone and Telegraph Company put up several long-distance circuits, those between Chicago and Minneapolis and between Chicago and New York giving remarkably clear transmission, and the companies' courtesy in supplying free service on both local and long-distance lines was greatly appreciated. Probably nothing that has yet been done will prove of so much importance in working out the Chicago telephone problem as their practical demonstration of the value to business and home of this service. The work of the operators was watched with the greatest interest, and Edwin F. Carter and Charles H. Gentry, who were indefatigable in their work of entertaining the visitors, reported many expressions of commendation and confidence.

The Chicago City Railway Company placed on exhibition one of its latest models for city and suburban service. This is a convertible car, with an overall length of forty-five feet, nine inches, equipped with two special Brill trucks, upon each of which are mounted two forty-horse-power G. E.-80 motors. A special motor suspension and the use of Schoen rolled steel wheels gives very smooth and practically noiseless running. Wheel-operated, pick-up brakes supplement the full air-brake system supplied by the National Brake and Electric Company. The car is equipped with air-sanders for sanding either rail by the use of a two-way valve. Consolidated Car Company side heaters are used, the seats are rattan covered, and the car is finished in mahoganized cherry and natural maple, with pantasote curtains. The car is illuminated by five thirty-two and twenty sixteen candle-power lamps. The thirty-twos are covered by frosted globes and are placed down the centre, while the sixteens are equipped with frosted bulbs and placed along either side. The particular feature of this car, however, is its sanitary possibilities. The entire floor-space may be easily mopped up and a new system of ventilation keeps the atmosphere of the car very clear. For the protection of passengers the platforms are equipped with receding side steps which makes it impossible to ride or entrain from the wrong side. There is a steel guard over the bumper and upon front and rear dashboard there is a heavily armored bull's-eye reflector headlight. The company was represented by Robert Grinnell.

The show was made more attractive to some of the visitors by the distribution of souvenirs, such as oxidized metal watch fobs on "Benjamin Franklin Day," January 17, gold stick-pins on "Thomas A. Edison Day," Wednesday, January 23, and miniature desk telephones on "Telephone Day," Monday, January 21.

On January 16, 17 and 18, the Northwestern Electrical Association held its annual convention, meeting in joint session with the Chicago branch of the Illuminating Engineering Society, on the evening of Thursday, January 17.

On the evening of Wednesday, January 16, the Rejuvenated Sons of Jove initiated a number of prominent members of the electrical fraternity into the order, after which a banquet was held, J. C. Fish, president of the Shelby Lamp Company, acting as toastmaster.

On the evening of Thursday, January 24, the annual meeting of the American Electrical Salesmen's Association was held.

All told there were about one hundred and twelve booths, the exhibits covering almost every conceivable electrical device and appurtenance.

The Allis-Chalmers Company made a well-chosen exhibit, the excellent finish and general order making it a most restful and comfortable oasis in a chaos of movement and excitement. The exhibit included a type AB, seventy-five horse-power alternator, ten horse-power induction-motor-generator set, fifteen horse-power high-speed-engine generating unit, type K direct-current motors from one and one-eighth to twenty horse-power, models showing moving and stationary blading of a 500-kilowatt steam turbine, and a fine collection of catalogues, bulletins and photographs. The company was represented by C. A. Tupper who was constantly in attendance, W. S. Heger, S. R. Kerr, J. W. Gardner, C. H. Melvey, C. S. Buell, Ervin Dryer, F. L. Webster, J. N. Denniston, E. R. Jacobs, D. K. Chadbourne, H. J. Keen, J. C. Buckbee, A. W. Catlin, L. St. J. Smith, P. C. Van Zandt, George Voight and C. H. Howe.

The American Steel and Wire Company attracted hosts to its exhibit of rail-bonds and tools, electric wires and cables, steel springs and specialties. The booth was cleverly fenced off with helices made up of copper wire, and the background was made up of triangular mesh concrete reenforcement, and wire railway fencing. A feature of this exhibit was a twenty-foot column upon which was wound 500 miles of telephone wire. The company was represented by B. B. Ayres, C. S. Knight, George Long and C. R. Sturdevant.

The Albert & J. M. Anderson Manufacturing Company made an exhibit of sample boards showing electric railway line materials, being represented by William Ward Hincher, of the Chicago sales department.

The American Sewer Pipe Company showed a line of single and multiple duct. This company was represented by W. R. Adams, J. M. McClave and Earl W. Hawke.

The Automatic Electric Company had one of the busiest booths at the show. The rapid development of and the publicity which has been given to this apparatus made a great appeal to the popular mind. The apparatus on exhibition included two "Keith units" of 100 switches each, connected by a trunking section, and representing a portion of two branch exchanges. Portable and wall telephone instruments were connected up so as to show the operation of "calling" and the working of the selector switches. The company was represented by H. H. Woodworth, J. A. Russell, R. B. Tyler, J. E. Fisher, C. L. Fisher, P. J. Eubanks, F. Lubberger and J. S. Engh.

The Central Electric Company made a most attractive exhibit of its many specialties, including Okonite wires and cables, D. & W fuses, Columbia lamps and other lines. The company was well represented by F. R. Bryant and J. W. Mason.

The Central Electric Manufacturing made an interesting exhibit of Black Hawk dry batteries, P. D. battery connectors and pocket ammeters. The company was represented by F. J. Alvin, manager, and G. W. Edge, Western sales agent.

The Chicago Battery Company made an exhibit of "Duro" portable storage batteries and "Duro" electric automobile and motor-boat reflector lamps.

The Chicago Pneumatic Tool Company had a moving exhibit of great practical

interest, showing the Duntley air-cooled motor-driven drills in various sizes, portable electric drills, grinders and buffers, and for the first time a portable alternating-current electric drill. These drills are now being made for sixty cycles, one, two and three-phase, and 110 and 220 volts. This company was represented by C. B. Coates, T. Appleton, C. E. Severin, C. W. Hayes and B. Rosenheim.

Frank B. Cook had up a number of standards showing pole cable terminals and guy clamps, and an iron distributing frame equipped with various types of Cook protectors and also showing the Cook self-welding wire joints. In this large and comfortable booth the visitors were entertained by John F. Tompkins, F. A. Rader, J. M. Moore, S. C. Harvey, E. M. Snow, F. R. Parker and F. W. Pardee.

The Crane Company made a fine showing with a huge U-bend of twelve-inch pipe, forming an arched entrance to the booth. The exhibit also included electrically controlled gate-valves and various steam-piping appurtenances. The company's representatives were J. A. Minwegen and John Collier.

The William P. Crockett Company made a pretty general display of specialties, including "Diamond H" switches, Bossert boxes, Pittsburg standard conduit, Sterling flexible conduit, Dale specialties, De Veau telephones, "Sarco" specialties and Keystone instruments. W. P. Crockett, A. C. Crockett, Maurice Levinson and S. H. Finney were the representatives.

The Dean Electric Company exhibited all the latest Dean apparatus for telephone work. The company was represented by W. W. Dean, A. E. Barker, George A. Scoville, A. B. Smith, E. M. Ford and A. A. Hathaway.

The Diehl Manufacturing Company showed a line of small apparatus, including printing-press motors, motor-driven buffing wheels and sewing machines, exhaust wheels, ceiling and desk fans.

The Joseph Dixon Crucible Company showed some special crucibles for melting brass, graphite lubricants, resistance rods and graphite specialties. The representatives were F. R. Brandon and B. B. Worley.

Dossert & Company made up a very attractive exhibit of Dossert joints, solderless connectors and terminals. H. B. Logan, J. J. Dossert, C. A. Flynn and E. A. Dossert represented the company.

The Duncan Electric Manufacturing Company had on view a fine line of Duncan alternating-current and direct-current wattmeters, including the monetary-type integrating wattmeters. The company was represented by W. H. Sinks, F. Lightner, E. C. Burch, Adrian Tobias and W. H. Hornberger.

The Electric Appliance Company exhibited a nine-foot sample board of "Sangamo" direct and alternating-current wattmeters; Packard "Gem" high-efficiency lamps, Packard transformers, "Eaco" telephones and "Paranite" rubber-covered wire reels.

The Electric Service Supplies Company showed a complete line of electric railway and mining supplies, Locke porcelain insulators, protected rail bonds, "Keystone" trolley material, Garton-Daniels lightning arresters, Hunter illuminated car signs, Wilson trolley catchers and retrievers, and arc headlights. The representatives were J. W. Porter, M. A. Berg, E. R. Mason, J. M. Gallagher, W. P. Casper, H. L. Adams, P. E. Davenport, M. S. Earl and W. J. Dukes.

The Electric Storage Battery Company had a large exhibit of various types of chloride accumulator and Exide batteries. A feature of this exhibit was the "R-85" tank of the same size as the eight batteries now being installed by the New York Central & Hudson River Railroad Company. The company also showed cells for railway and lighting work, telephone work and for other classes of electrical work; car lighting batteries and batteries for electric vehicles and ignition service, portable batteries for phonograph, medical and other applications. Represented by G. H. Atkin, J. M. S. Waring, H. B. Marshall, W. F. Rath, W. F. Bauer and F. W. Hyde.

Erwin & Company drew a goodly crowd to its booth, where several motor-driven house pumps were at work. The automatic electrically operated seepage ejector was the centre of attraction. The company was represented by O. R. Erwin, Henry Erwin, A. C. Durdin, Jr., and Morris Weil.

The Eureka Electric Company showed a fine line of telephones and switchboard apparatus. V. H. Messenger, G. H. Miller, F. H. Holroyd, V. H. Mehren and Mr. McCoy entertained the visitors.

The Federal Electric Company made a fine showing with its various forms of unit electric signs. Of course this booth was brilliantly lighted. This company was represented by its popular president, James M. Gilchrist.

The Fort Wayne Electric Works showed its series alternating arc-lighting system, twenty-five-light capacity; standard switchboard; type SA regulator and type A transformer; types K and W single-phase, multiphase and prepayment wattmeters. In another part of the building a 150-kilowatt motor-generator set of this company's make furnished energy for the exhibitors at the Electrical Show. This generating unit comprises a direct-current motor fed from the Chicago Edison Company's mains, and belted to a 150-kilowatt, multiphase alternator.

The General Electric Company made a splendid showing with its heating and cooking apparatus and its incandescent lamp decorations. The incandescent lamp units of various forms were stretched in rows across the top of the pagoda, and these were alternately flashed on and off in sections by a large flasher which was tastefully arranged in a china closet. The exhibit of the new tungsten lamp at this booth was one of the features of the show. This was the first public exhibition of this lamp, and considerable interest and attention were attracted. The General Electric Company's engineers have been able to produce tungsten filaments which give excellent life results at the high-efficiency of one and three-quarters watts per candle. Tungsten is a metallic element discovered in 1781. It is not found native, but occurs as the tungstate of iron, as manganese in the mineral wolframite, and as the calcium tungstate. The filaments of the tungsten lamps exhibited were made by processes developed by the General Electric Company in its own laboratory. The lamps exhibited consume 105 watts, giving about eighty-five candle-power mean horizontal. The life of the lamp is approximately 700 to 1,000 hours, and appears to be equally good on either alternating or direct current. The lamp is not on sale or listed as yet, but it is probable that in the near future the units will be available in large quantities. The company was directly represented by E. L. Callahan, and the demonstrators were Miss Lyons and Miss Potts. Frank H. Gale was also very much in evidence, and F. W. Willcox also entertained the visitors.

The Gould Storage Battery Company made its usually attractive display, the exhibit including a forty-nine-plate cell, U type, having a capacity of 7,200 amperes. This was placed in a special lead-lined tank and was equipped with a lead-glass cover. Other features of this exhibit were a type S nineteen-plate cell, 1,800-ampere regulating battery; type O twenty-one-plate cell using an Appert glass tank, 1,000 am-

peres regulating capacity; type N nine-plate cell, eighty ampere-hours capacity; type M nine-plate cell, forty amperes capacity, and a miscellaneous assortment of couples, ignition sets, train-lighting sets, and sample boards showing parts of positive and negative plates. There were also a number of photographs of typical installations. The company was represented by R. H. Watson, E. M. Hervey, John Eipper and H. N. Powers.

The Haller Machine Company made a very attractive exhibit of flashing and steady-light electric signs. The main feature of the exhibit was the reproduction of a well-known brewing company's trade-mark, made up in a sign twenty-three feet by forty feet. An eighteen-foot letter K, a portion of a sign 250 feet long by forty feet high, was also shown. This sign is being made by the Oliver Plow Works, South Bend, Ind., and is intended to be readable at a distance of five miles. The Haller Machine Company was represented by William Goltz.

J. Allen Haines was a busy man, representing the following companies: American Electrical Heater Company, electrical heating apparatus, including the new steel-clad laundry irons; Bishop Gutta Percha Company, sample board of insulated wires and cables which was displayed at the Centennial Exposition in Philadelphia in 1876; Clifton Manufacturing Company, friction tape, insulating tape, insulating compounds; Dayton Electrical Manufacturing Company, "Apple" ignition system; Electric Cable Company, "Voltax" insulated wires and cables; Schwarze Electric Company, "Universal" bells and gongs and railway signal apparatus; Stanley & Patterson, Incorporated, "Matchless" flashers, "Imperial" sunlight reflectors, "Newcode" receptacles and sockets, "Fielding" stage receptacles, Hubbell floor boxes; the Wire and Telephone Company of America, sample board of "Romeoid" wires, magnet wire, telephone wire, "Easophone" equipments.

The Holtzer-Cabot Electric Company showed an interesting line of watchmen's clocks, interior intercommunicating telephones, weatherproof telephones, police telephones, standard and weatherproof loud-ringing gongs, vibrating bells and standard telephones, annunciators, single-phase motors, direct-current motors, storage battery charging motor-generator sets, signaling devices, watchmakers' lathe motors and dental lathe motors, portable telephones for interurban railways, and the "Flexiphone" adjustable telephone bracket. The company was represented by E. R. Harding, A. E. Klunder and T. G. Meinema.

Felix Hamburger's exhibit of flaming arc lamps attracted a great deal of attention. Max Austrich, the representative in charge, was kept busy explaining the characteristics of these illuminants. Considerable interest was also shown in the "Liliput" direct and alternating-current, two and three-ampere arc lamps.

The H. W. Johns-Manville Company made an interesting and comprehensive exhibit of a number of its specialties. Those particularly in evidence were "Victor" direct-reading voltmeters, ammeters, combination volt-watt-ammeters, both portable and switchboard types, and a special "Victor" combination meter for automobile use; "J.-M." friction tape; "Noark" subway and service boxes; "Noark" National Standard fuses, fuse blocks and accessories; "J.-M." overhead line material, and "Transite" asbestos fireproof lining.

The Kellogg Switchboard and Supply Company was represented by Robert C. Dyrenforth and a corps of assistants. The exhibit included a 100-line express-type magneto switchboard and telephones, and a central energy private branch exchange switchboard with common battery telephones. There was also an eight-party harmonic selective system operated from a frequency pole-changer and transformers, showing the latest improvements in modern party-line systems.

The Lafayette Electrical Manufacturing Company made an exhibit of Hornberger transformers in conjunction with the Duncan Electric Meter Company. The company was directly represented by W. H. Hornberger.

The National Carbon Company created quite a sensation with its building, which was composed entirely of massive carbon electrodes, such as are used in reduction processes. The interior of the exhibit was composed of various carbon products, including arc-light electrodes, brushes and dry battery parts. The company was represented by N. C. Cotabish, sales manager; A. V. Ward, A. L. Haskill, C. W. Wilkins, E. J. Kenny and Wallace O'Connor.

W. N. Matthews & Brother exhibited the "Stombaugh" guy anchor, showing the way in which this device is screwed into the ground, by placing in a large box-panel a cross-section of earth through which the anchor had been driven; "Kearney" cable clamp, "Hold-Fast" lamp guard, "Lima" jack box and plug, "Hargis" splicing joint, "Callahan" rollers, "O. K." slate cutters. Represented by W. N. Matthews and Claude L. Matthews.

The National Battery Company showed the "Unit" accumulator in small couples or two-plate cells suitable for low discharges, adapted for telephone exchanges and private exchanges; fire and police alarm telegraph systems; samples showing the construction of the positive and negative plates.

The National Electric Lamp Association had one of the feature exhibits of the show. The newer types of incandescent lamps were well represented and the 100-watt, eighty-five candle-power tungsten lamps were shown mounted upon uprights, showing the application of these units for street lighting. This booth was headquarters for the Brilliant Electric Company, which showed the new forty-four-watt special Brilliant lamp, the Bryan-Marsh Company, the Buckeye Lamp Company, the Colonial Electric Company, the Columbia Incandescent Lamp Company, Economical Electric Lamp Company, the Fostoria Incandescent Lamp Company, the General Incandescent Lamp Company, Jaeger Miniature Lamp Manufacturing Company, New York & Ohio Company, the Shelby Electrical Manufacturing Company, Sterling Electrical Manufacturing Company, the Sunbeam Incandescent Lamp Company, the Sunbeam Incandescent Lamp Company of Canada, Limited, and the Warren Electric and Specialty Company. Supporting this booth were J. C. Fish, president of the association and president of the Shelby Electrical Manufacturing Company; E. S. Doane, chief engineer of the association; L. P. Sawyer and J. H. Cooke, of the Buckeye Electric Company; E. J. Kulas and E. V. Hennecke, of the Brilliant Electric Company; William Coale and R. M. Ryckoff, of the Sterling Electrical Manufacturing Company; Edwin Irving, of the Sunbeam Incandescent Lamp Company of Canada, Limited; H. H. Geary, of the Fostoria Incandescent Lamp Company; W. M. Skiff, of the engineering department of the association; E. H. Haughton, George Lockwood, F. M. Henkel, J. S. Corby, J. L. Barnard, F. W. Godfrey, M. L. Spaulding, Sam Furst, J. G. Peters, P. R. Slocomb, R. D. Cummings, W. R. Collins, L. E. Mason, R. M. Cole, E. N. Mullen and W. G. Reid, of the Bryan-Marsh Company; Col. E. E. Nash, of the Warren Electric and Specialty Company; H. B. Vanzwoll, Sunbeam Incandescent Lamp

Company; L. Lobenthal, Economical Electric Lamp Company; H. M. Vanzwoll, of the National Electric Lamp Association; W. J. Trott, Fostoria Incandescent Lamp Company.

The Oneida Community, Limited, made a fine showing with its galvanized arc lamp chain. In the centre of the exhibit there was erected a bracket arm post with a weatherproof arc lamp suspension, demonstrating the lifting qualities of the Oneida galvanized chain.

The H. A. Petersen Manufacturing Company attracted a great deal of attention with an electrically driven ammonia compressor and refrigerating system. In addition to this demonstration there were in evidence several specialties, including "Harveyduct" electrical conduits and fittings.

The Phœnix Glass Company made a very pretty exhibit of electric lighting glassware, including etched, cut, decorated and other effects; the Phœnix inner globes for arc lamps were also shown. The representatives were A. H. Patterson, E. H. Fox and C. C. Fricke.

The Reynolds Dull Flasher Company exhibited a great variety of flashers. The big flasher, looking very much like a forty-inch blower wheel, which flashed the lights in the "dancing devil," attracted much attention. The company was represented by Egbert Reynolds Dull and John Friis.

W. H. Schott established a fine reception room, which was much appreciated by a host of visitors. The treatment of this booth carried out the idea of a living room of Colonial times, including a fireplace and a massive mantel. The decorations were in purple and white, and the visitors were entertained by Mr. Schott, M. O. Payne, D. T. Wallace, C. A. Gillham and F. B. Hofft.

The J. L. Schureman Company made a display of automatic pump starters, elevator controllers and magnet switches. J. L. Schureman, Frederick Nelson and Sherman M. McFedries represented the company.

The Simplex Electric Heating Company showed a complete line of electric heating and cooking appliances, distributing many electrically cooked dainties to the visitors. Represented by H. R. Hixson, F. S. Richards, E. A. Strauss, J. N. Macallister, J. G. Brobeck and W. F. Hruby.

The Stromberg-Carlson Telephone Manufacturing Company made an elaborate exhibit of magneto and common battery switchboards and telephone instruments, portable and desk telephones, private and intercommunicating instruments. This apparatus was in good working order, and attracted an unusual amount of attention. The spectacular feature of the exhibit was an immense map of the United States, showing, by means of opal lights, the location of some of the independent telephone exchanges using the Stromberg-Carlson Telephone Manufacturing Company's equipment. The company was very ably represented by J. O. Oliver and others from the sales department.

The Thordarson Electric Manufacturing Company made one of the most interesting exhibits at the show. Some of the features were ignition coils, high-potential transformers and special laboratory apparatus. One device which attracted a great deal of attention was an auto-engine magneto. This consisted of a magneto built with an auto-engine flywheel and giving a hot, fat spark for any number of cylinders. The construction of the magneto is such that a heavy spark is given down to the last half-turn of the flywheel. The dimensions and weights of the flywheel are not changed and the magneto construction is very simple and easily accessible.

The Vote-Berger Company showed for the first time its celebrated common battery multiple switchboard working without relays. This board is operated with a lamp ballast. There was also a 300-line magneto switchboard and common battery and magneto telephones. This company also had on exhibition a line of "D. & T." guy anchors and "Two-Balls" cord adjusters. The company was represented by W. A. Grimes.

The United Indurated Fibre Company made an extensive exhibit of indurated fibre insulation for under-running and over-running third-rails, conduits, transformers, circuit-breakers and cable-ways.

The Universal Electric Storage Battery Company showed a private house lighting plant complete, including Fairbanks-Morse gasolene engine belted to a Crocker-Wheeler three-kilowatt generator. A. F. Callahan, Walton Bentley and J. S. Burnet represented the company.

The Vulcan Electric Heating Company afforded many interested visitors a practical demonstration of the utility and economy of electrical soldering appliances. A number of electric heating appliances for industrial use were shown at this booth for the first time. Nothing, however, was exhibited but what had demonstrated through long service its practicability. Among the new things shown were a three-eighths-inch soldering iron with a fine point for telephone construction work, an electrically heated soldering pot, an incense burner, a water heater and several forms of branding irons. There was also shown a particularly useful device in that it fills a demand which has existed for a long time. This was a tool which removes the nap formed upon the edge of the blankets used upon rotary printing presses. Heretofore it has been customary to lay up the machine for some time while a man

THE WESTINGHOUSE COMPANY'S EXHIBIT, SHOWING ONLY A FEW OF THE MANY MOTOR-DRIVEN MACHINES FOR INDUSTRIAL AND DOMESTIC APPLICATION.

trimmed down this nap, at a great expense of time. With the new tool the scurf can be charred off and a perfectly smooth surface effected almost as fast as the cylinder of the press can rotate. Another very practical tool was an electrotyper's instrument made in the form of a blunt-end burnisher with a conical pein. The conical pein is used in setting up the wax in an electrotyper's plate, and the blunt end is used in heating the knife blade in trimming, and is also used as a fixing tool for clamping the plate to the block. It was the pretty general opinion that this exhibit has established very clearly the economy and utility of electrical heating devices for industrial purposes, and had consequently given the whole industry a very good push forward. The company was represented by F. J. Holmes, L. P. Brown, G. M. Cox and J. W. Fay.

ONE END OF THE GENERAL ELECTRIC COMPANY'S EXHIBIT, GIVING A GOOD IDEA OF THE LAMP DISPLAY.

A FEATURE OF THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY'S EXHIBIT —A HUGE ILLUMINATED MAP SHOWING THE LOCATION OF TELEPHONE EXCHANGES EQUIPPED WITH THIS COMPANY'S APPARATUS.

The Wagner Electric Manufacturing Company made a very good showing with its single-phase elevator motor complete with controller. This apparatus attracted a great deal of attention from both central-station men and owners of buildings requiring elevator service. These motors are built by the Wagner company in sizes from five horse-power to twenty-five horse-power. The exhibit also included a Wagner transformer, a display of switchboard and portable instruments, variable-speed single-phase motors, a motor-driven centrifugal pump and polyphase motors. These motors are built in sizes up to 100 horse-power. The company was represented by F. N. Jewett, C. C. Warner, C. B. Richardson, T. M. Combiths and V. D. Bergenthal.

The Western Electric Company was the centre of attraction for visiting engineers, particularly those interested in power apparatus. The feature of this exhibit was the frame and armature winding of a large size Western Electric revolving-field engine-type alternator. As offsets to this large piece of apparatus there were exhibited a number of smaller motors and generators. The publication descriptive of the Hawthorne works was also very much in demand. The exhibit included "American" transformers, "Thomas" high-tension insulators, "Electrose" insulating material, Western Electric arc lamps, field coils, induction motors, sewing-machine motors, and a number of other specialties. The Ballou-Hutchins Electric Company exhibited automatic time switches at this booth. The company was represented by H. A. Halligan, C. A. S. Howlett, I. Hulett, John Dietrick, H. E. Griffin, H. J. Elliott, I. Young, Irving Parker, William Self, F. T. Murphy, F. R. Babcock, H. A. Hoagland, O. B. Duncan, W. H. Woods, B. S. York, L. J. Baldwin, O. O. Tucker, C. Garner, H. D. Haring, H. W. Dye, M. R. Lash, R. M. Baker, D. C. Guest, W. W. Templin, P. Joyslin, F. H. Hulscher, A. R. McNally, R. C. Kearslay, G. H. Lounsbery, F. A. Henderson, F. H. Boardman, W. L. Stockton and H. Walton Heegstra.

The Westinghouse Companies made a most attractive exhibit, and as far as public interest is concerned, was probably the most successful exhibitor on the floor. This exhibit included a large number of devices which were of particular interest to not only the central-station man and the engineer interested in the developments of electrical apparatus, but to the hotel keeper, the restaurant owner, the builder, the architect and the householder. In addition to the standard line of volt-

meters, ammeters, lightning arresters, fan motors, small alternating-current and direct-current motors, railway line material, pipe-thawing transformers and circuit-breakers, there were in operation a motor-driven washing and wringing machine for household use, and a large motor-driven washer for general laundry work. There were also electrically driven mangles, sewing machines, ticket punchers, plunger pumps, ice-cream freezers, forge blowers, ice-making machines, lathes, coffee grinders and dish washers. The motor-driven dust remover was particularly in evidence, and it was a surprise to many to see the volume of dust which could be picked from one's clothes and sent whirling into the glass dust chamber. The exhibit was lighted by means of direct-current series arc lamps and alternating-current multiple arc lamps. Street series Nernst lamps were also used in the illumination, along with both type H and type K Cooper Hewitt mercury vapor lamps. Among the representatives in attendance were J. C. McQuiston, T. P. Gaylord, E. N. Bischoff, A. L. Millard, T. P. Pinckard, S. L. Nicholson and Charles Robbins, for the Westinghouse Electric and Manufacturing Company; Max Harris, C. H. Davis and Frank McMasters, for the Nernst Lamp Company, and George C. Keech for the Cooper Hewitt Electric Company.

Among the souvenirs distributed were watch fobs, by the Oneida Community; match-boxes, by the Chicago Pneumatic Tool Company; pocket mirrors, by the Brilliant Electric Company and the International Electric Meter Company; mechanical crickets, by the Western Electric Company; a most ingenious and exasperating puzzle, by the Holophane Glass Company; change purses, by the Duncan Electric Manufacturing Company; bill and card cases, by the American Sewer Pipe Company; oxidized copper cigar-holder and ash-tray, by the Stromberg-Carlson Telephone Manufacturing Company.

In addition to the representatives of the manufacturers who had exhibits at the show there were in evidence as visitors a great many well-known members of the electrical fraternity. Among these might be included R. P. Tell, vice-president and general manager, National Brake and Electric Company; Arthur Jones, Arthur Jones Company; A. R. Bliss, secretary and treasurer, New England Motor Company; A. J. Marshall, illuminating engineer, engineering department, and C. A. Howe, general sales manager, Holophane Glass Company; C. A. Ballou, president, the Ballou-Hutchins Electric Company; Philip R. Fisher, western sales manager, Condit Electrical Manufacturing Company; H. L. Wells, Power and Mining Machinery Company; Howard M. Post, Quincy-Manchester-Sargent Company; George S. Searing, Hart & Hegeman Manufacturing Company; T. P. Gleeson, of Smiley & Gleeson; E. L. Haines, National X-Ray Reflector Company; George Cutter, president, George Cutter Company; L. H. Keller, secretary, Union Electric Company; A. N. Fox, advertising manager, Benjamin Electric Manufacturing Company; Percy Ingalls, commercial agent, electric department, Public Service Corporation of New Jersey; George W. Rodormer, American Electric Fuse Company; C. A. Parker and C. H. Johnston, Curtis Advertising Company; C. F. Hinman, the W. R. Garton Company; George H. Erich, Consumers' Electrical Supplies Company; Francis Raymond, W. S. Sisson, D. & W. Fuse Company; Ralph A. Schoenberg, president, Sarco Company; T. F. Clohesey, Chicago, and H. J. Metzgar, Elkhart, Ind.; R. C. Lanphier, Sangamo Electric Company; H. A. Hammond; F. M. Potter, Wire and Telephone Company of America; W. H. Jacobs, Triumph Electric Company; D. L. Markle, Mark Manufacturing Company; C. H. Norwood, Robbins & Myers Company; Robert Kuhn, American Electrical Heater Company, and C. B. Roulet, Texas Fire Prevention Bureau.

The Strength of Elm, Oak and Locust Insulator Pins.

At the request of certain consumers, the Forest Service of the United States Department of Agriculture recently made tests on fifty-three insulator pins of rock elm, live oak and black locust. The tests were made at the timber-testing station of the forest service at Purdue University, Lafayette, Ind. The results indicate the relative strength of the pins tested. They depend upon too small a number of tests, however, to show in an authoritative way the relative value of these woods.

The pins were of standard size, one and one-quarter inch by eight inches. The oak pins were from one-eighth to one-quarter inch shorter than the others, and of slightly smaller diameter at the shoulder. Their lever arm was also about one-half inch shorter than in the cases of the other two species.

In testing the pins an iron block was clamped to the fixed upper head of a small screw-testing machine. The pins were inserted to a tight fit in a hole in this iron block, and projected horizontally over the pulling head of the machine. The glass insulator was unable to bear the strain of the wire, so an iron model of the ordinary glass insulator was screwed on the pin and connected by means of a heavy wire to the pulling head of the machine. When a strain was put on this wire the pin acted as a beam fixed at one end and loaded at the other, which is practically the condition met with in practice. The breaking moment (maximum load times lever arm) is taken as a measure of the strength of the pins. The iron block mentioned was used in preference to a wooden cross-arm for supporting the pins for the reason that this iron block forced the pins to break under the test. Furthermore, it furnished uniform conditions for all pins. Thus the results of the tests do not show the strength of a combination of pins and cross-arm, but they show the bending strength of the pin itself.

The accompanying table gives the results of the tests.

Species.	No. of Tests.		Weight of Pin. Grammes.	Rings per Radial Inch.	Breaking Moment. (Maximum Load × Lever Arm.) Inch-Pounds.
Black locust from Boston, Mass.....	23	Avg.	106.3	12	3,970
		Max.	119.3	25	5,380
		Min.	86.6	3	2,520
Black locust from Nashville, Tenn.....	7	Avg.	125.9	8	4,087
		Max.	147.1	11	4,930
		Min.	111.8	4	3,010
Rock elm from Nashville, Tenn.....	8	Avg.	93.8	42	2,512
		Max.	108.7	48	3,150
		Min.	77.5	33	1,450
Live oak from Houston, Tex.....	12	Avg.	127.1	Not	3,025
		Max.	141.0	distinguish-	4,590
		Min.	110.4	able	1,990

From the table it appears that the breaking strength of the two shipments of black locust pins was practically the same, and may be taken as 4,000 pounds. Live oak pins came next in order of strength, with a breaking moment of about 3,000 pounds. Rock elm pins were the weakest, having a breaking strength of 2,500 pounds.

The oak pins were the heaviest, the locust next and the elm the lightest.

The locust and elm pins failed mostly by splitting from the threads to the shoulder, or by tension at the shoulder. Occasionally the portion of the pin inserted in the block failed by shearing horizontally. The oak pins nearly all failed by tension at the shoulder.

Joint Meeting of Chicago Illuminating Engineers and Northwestern Electrical Association.

On Thursday evening the Northwestern Electrical Association held a joint meeting with the Chicago branch of the Illuminating Engineering Society. The serious discussion of the evening was preceded by an informal dinner, for which about 130 covers were laid. Discussion was invited upon the three following topics:

1. "Large *vs.* Small Units in Street Lighting."
2. "Globes and Reflectors for Street Lighting."
3. "New Street Lights."

Opening the discussion, Albert Scheible called attention to the necessity for establishing a street-lighting system which would give not only effective illumination of the ends of the block, but also light up the mouths of the alleys running back from the streets, so that the police function of the light might be fully realized. The present scheme of lighting was not good, he thought, because the plane of maximum illumination was too low. The illumination should not serve only as a path-finder, but should be best at such a height that the face of pedestrians could be clearly distinguished. The tendency should be to horizontalize the illuminating effect.

W. D'A. Ryan thought that everything depended upon the local conditions and applications. The illuminating engineer should take the present arc lamp consuming four amperes at the arc and push the current consumption up so that a greater quantity of light would be available. Incandescent lamps for street lighting should have a minimum of at least fifty candle-power, and some form of reflector should be used.

Frank McMasters thought that high-candle-power units had a tendency to close the pupil of the eye so that the eye was not able to absorb enough of the reflected light to make the illuminating value effective. The incandescent lamp, he thought, was not good for outdoor lighting because of its color.

R. W. Bingham discussed the use of sixty-candle-power Welsbach gas lights for street illumination. He thought that electrical engineers were obliged to place their high-power arc lamps too far apart because of their first cost and up-keep to properly illuminate the entire length of a street. The height at which the arc lamps were placed was also a disadvantage because of the screening effect of foliage in many quarters. One of the principal advantages of the Welsbach mantle light was that it was placed at such a height above the ground that this screening effect was not noticeable. Another advantage was the horizontal distribution of the Welsbach mantle. He did not think that the great improvements which had been made in gas lighting and gas-lighting appliances were properly understood or appreciated.

E. M. Tompkins said it was a question of what would satisfy the people and at the same time not be prohibitive in the point of maintenance. It was easy to place enough units in any street to give any quantity of effective illumination, but it was not so easy to secure appropriations to do this.

Mr. McMasters then made a statement giving some comparisons taken from the 1906 report of the department of electricity of the city of Chicago. Arc lamps taking 505 watts at the bus-bars cost for one year $52.63, or 0.2161 cents per candle-power. Mantle gas lamps, including all labor and material, with gas at $1 per 1,000, three and one-half feet of gas per hour, 3,786 hours, sixty candle-power, cost $20.36 per year, or 0.3993 cents per candle-power. Open-flame lamps, including all labor and material, with gas at $1 per 1,000, three feet of gas per hour, 3,786 hours, twenty candle-power, cost $16.11 per year, or 0.8055 cents per candle-power. Gas mantle lamps, sixty candle-power, by contract, cost $25.80 per year, or 0.42 cents per candle-power. He stated that Nernst lamps or fifty candle-power for similar service would cost 0.2878 cents per candle-power.

Francis W. Wilcox thought there was a strong tendency to distribute a large number of smaller units at more frequent intervals. The race will go to that unit which will permit of the best uniform illumination. The improvements now being made in the incandescent lamp will accentuate the use of the small units for effective lighting. There was also a tendency toward decorative lighting and artistic and gala effects. The incandescent lamp readily lent itself to the production of these effects.

Harold Almert thought the smaller unit would be desirable if the maintenance and construction costs were not prohibitive. He could not see at this time how a system of installation could be worked out for the use of the smaller units without very greatly increasing the cost of construction.

J. S. Allen stated that in Lake Geneva, Wis., he was using alternating-current multiple incandescent lamps, distributing at 2,400 volts to transformers. He had been surprised at the cheapness of the installation and said it was giving satisfaction. Thirty-two-candle-power lamps were used, the people were paying more for their light and seemed to be satisfied to do it.

A. J. Marshall called attention to the losses which took place when several Welsbach mantle lights were used in place of a single light. Where four mantles are used there is thirty per cent less efficiency than for the single mantle. One thing which appealed to him in the illumination question was the aggravation caused by the use of bare lights. It was also a mockery, he thought, to put an opal or milky globe, or even a frosted globe over an incandescent lamp. To be sure, this caused some diffusion of the light, but there also remained a ball of fire which was visible. Some form of globe should be used which would have the proper diffusing effect and at the same time remove the glaring effect of the source of light. He was in favor of smaller units properly disposed on artistic posts. Not enough attention was being given to creating artistic applications of illuminating apparatus.

J. R. Cravath said it was a question of the total amount of light distributed over the length of the street. Of course, in some places a high-power arc light could be used without any disastrous effect, but where it was attempted to use a small amount of energy in a large unit the effect would be very bad.

W. D'A. Ryan called attention to the use of the concentric diffusing reflector for store illumination and distributed a number of photographs showing effects produced with this form of illumination.

F. W. Wilcox thought that the tungsten lamp working at one and one-quarter watts per candle would seem to lend itself to street series systems. Low-voltage filaments can now be made for fifty candle-power or higher so durable that a life of 1,000 hours is accomplished with a well-maintained candle-power.

Following the discussion the report of the nominating committee was heard and a single ballot was cast for the following permanent officers:

Chairman: George C. Keech.
Secretary: J. R. Cravath.
Managers: H. V. VonHolst, E. W. Lloyd.
Examiners: W. R. Bonham, C. E. Ummach.

Mr. Keech and Mr. Cravath both spoke briefly concerning the possibilities of a permanent organization and pledged themselves to make every effort to carry on the work which had been started so well.

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

The Supporting of a Central Station's Supporters—How the Local Merchant May Be Won Over to Become a Strong and Aggressive Ally of the Lighting Company.

SUPPORT YOUR SUPPORTERS.

Central station managers should not forget to do a friendly turn for their best supporters—the home merchants—whenever opportunity presents itself.

The big mail order houses of the country are the bane of the local merchant.

The use of incandescent lamps in illuminating triumphal arches and more permanent street structures is gaining headway very rapidly and affords a further field for the enterprising current-seller to cultivate and foster to his company's profit and the beautification of his city.

When the citizen wants to borrow some money to help out on his taxes, or to buy a bill of necessary goods on credit, does he go to the mail order houses?

No; he goes to the merchant every time, and he gets the money.

When the same citizen has some spare change jingling in his jeans, what does he do?

Does he think of his obligations and go and settle with the long-suffering and forbearing merchant?

No; he begins to fumble over the leaves of the big mail order catalogue and sends off his money to buy—what? "a cat in a bag."

Whose money?

Why the local merchant's money.

The citizen actually takes the local merchant's money to patronize and support his opponents.

The mail order catalogue quoted the price at $6.98—"same as you will pay your local merchants $12.00 for—"

Mr. Citizen accepts this statement as gospel, and it doesn't require any argument to satisfy him; he isn't from Missouri.

There seems to be a sort of silly fascination about this mail order purchasing. People seem to think they are "doing business" when they step up to the Post Office window and deposit their money—the merchant's money—for a piece of paper and then pay postage for the privilege of sending it to some big mail order concern.

"Buying goods at wholesale" they will tell you; it sounds big, looks big, but a lot of it is very nonsensical.

Self-preservation ought to be the first law of nature and is, ordinarily; but in this business the citizen seems to forget that the mail order houses do not pay any taxes in their town, nor, Mr. Central Station Man, do they spend any money for electric current in your town; and right there is where you can slip in an undercut once in a while which will please your local merchant mightily and incidentally cause his customers to "sit up and take notice."

They will notice it the more because of its unusual source.

They are used to having the merchant croak, as they call it, in his advertisements, about supporting home trade, etc. "Oh! that is a chestnut; we have heard that before!"

But you, central station man, work in something like this in your local newspaper advertising space once in a while—the newspaper can afford to help out on this proposition, too; it is meat for it as well as you, and you are all in the same boat; if the local merchants succeed, you all succeed!

PEOPLE OF BLANKVILLE!

¶ **Spend your money with the Merchants of Blankville—**

THEY ARE YOUR FRIENDS

You go to them to borrow money when you get in a tight place—

YOU PATRONIZE THEM when you are out of money—and you get the goods. Be honest and stick to home trade through thick and thin.

Montgomery, Ward & Company do not pay for lighting on streets of Blankville; neither do Sears, Roebuck & Company pay taxes in Blankville!

The ONLY WAY to have a GOOD TOWN, and a prosperous town, is for all to stand together.

¶ **Stand by those who stand by you.**

Under this heading we shall, from week to week, present to our readers a little series of inspirational aphorisms (original, aboriginal and selected), which will, we believe, prove stimulating and suggestive to those who are interested directly or indirectly in the sale of central station current.

Investigate—you'll find the apparent obstacles are not as hard as they seem.

When entering a business place, be courteous.

Even if it's the office boy, it pays to be polite.

When your company asks you to sell current, don't explain why you couldn't sell it—report that you have sold it.

Believe only half you hear—and be careful which half.

Have your mind in order.

Observe closely and watch your prospective customer when he is wavering.

That's the time to drive your nail home

Remember electric light will not explode.

It gives no fumes—it burns without oxygen.

It doesn't smell—it doesn't smoke.

It won't set lace curtains afire—it's instantaneous.

Have all the points at your tongue's end—be ready with them.

Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Boys, I notice that every once in a while hypocrisy gets in amongst us and does a whole lot of damage.

Now, I don't mean anything to do with religion.

There is lots of hypocrisy outside the church altogether.

Last Monday, one of you fellows came to me after our little meeting and pretended to be in a perfect glow of enthusiasm about what I'd said and how it had braced you up.

In most every city there is an enterprising hotel proprietor who would not blink at paying the price for an electrical display of this kind if the matter was properly and forcibly presented to him by the local central station. Are you working *all* the possibilities?

Now, I thought at the time that his tone lacked sincerity and I was especially doubtful about the truth of it, because I'd particularly noticed while I was talking that he had a far-off look in his eyes and I don't believe he had the faintest inkling of what I was talking about.

He was thinking about some girl or something.

Now, you're at perfect liberty to listen or not when I'm giving you these little talks and I'm the last man to get sore on that account, but I do object strongly to that hypocritical spirit which leads you to pretend to have a whole lot of enthusiasm which you didn't really have.

And I've noticed all week that it was a bluff.

Your heart hasn't been in your work.

And you haven't had the goods with you.

Results show it, too.

Now, I claim that cultivation of a false or hypocritical spirit of enthusiasm is the most pernicious thing you can foster.

For your own sake, be square with yourself—if you're not with any one else.

Here's the worst feature of it—that falsely generated enthusiasm is so apt to become second nature and will in time be likely to displace, disqualify and discredit the real thing.

I believe this. I'd rather see you occasionally refuse to enthuse. We can't always be keyed up to 100 per cent; there must be weeks when our ginger will get below par; our livers will once in a while get out of order.

When we feel that way let's get over it as quickly as possible, but don't pretend to get over it.

Central station men are commencing to realize the splendid opportunities for the sale of late-at-night current afforded in the lighting of bill-boards, wall signs etc. The local bill-posters, sign-painters, etc., may readily be interested in the illumination of signs and sign locations, inasmuch as it is easy to demonstrate to them that their advertising is thus rendered far more effective and resultful by reason of its longer hours of usefulness. This excellent example is an installation of the Chattanooga Electric Company, Chattanooga, Tenn.

Remember what I'm constantly trying to drive into your heads:

Work isn't a hardship.

It's the only thing worth living for.

Just try and recall the most pleasant day you ever lived.

Wasn't it a day on which you did an unusually good day's work?

It wasn't a day you went on a pleasure trip and shirked some work you should have done.

That I'll bank on.

Fellows, if your heart is on straight and in the right place, you'll think more kindly of work with every ounce of it you do.

Well, let's go out and gather in the sheaves.

Put your back in it, fellows.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central-station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

The Sheboygan Light, Power and Railway Company, Sheboygan, Wis., has a lively and hustling bunch of officials and solicitors.

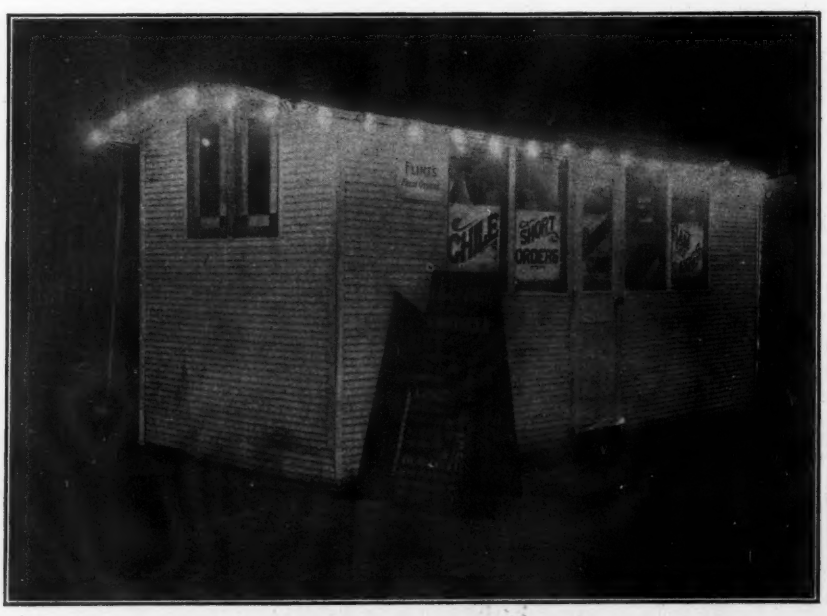
Every Monday evening they all get together in the "back office," relate experiences, compare notes, and give each other advice. As a result there is a thorough understanding throughout the whole force, and a general feeling of "get a hunch on" all through the week following.

The evening the writer called in there were no less than eight members present, and they were all made to see things from every point of view. It is a sure thing that you never find a "dead one" when they all get together once a week. Try it; get the boys all in once a week, "open something" and talk things over—you will be surprised how much can be learned, even by the chiefs.

By the way, this company has also started on a campaign of direct-by-mail advertising. You may expect to see things grow electrically in Sheboygan. A good show-room and competent office attendants also help things here.

When a customer comes in to find out why, he knows a lot about electricity when he leaves—that counts a whole lot.

The Citizen's Electric Light and Power Company, East St. Louis, Ill.—This progressive central station reports a pleasing condition with regard to growth of new business, and the tangible evidence of the fact that this growth has been of considerable proportions is furnished by the company having found it necessary to add recently a 500-kilowatt, sixty-cycle turbo-generator. T. W. Gregory, treasurer of the company, reports that business is growing all the time.



A noteworthy electrical installation showing how the well-trained soliciting force in a large city gathers in not merely the largest but the smallest consumers of current. This illustration represents a night lunch-stand at a street corner in Denver, and is the last place where the average new-business man would be inclined to think that "lightning would strike." The Denver Gas and Electric Company leads the van for new-business progressiveness.

The Northern Ohio Traction and Light Company, of Akron, Ohio, has recently entered upon an aggressive campaign for new business, has installed active and efficient heads of departments, got the direct-by-mail habit of advertising, bought out another traction line, etc. The management of the heat and light department has made an early date with a prominent advertising concern for a thorough and systematic campaign of special work. It needs the business and is going after it, confident that this will not come to it unsolicited.

Tryon Brothers, owners and operators of the Maumee Electric Company, of Maumee, Ohio, are sure enough practical men: they not only climb the poles and adjust the wiring, but they both climb for business. They have more than doubled the output of current during the past year by personal solicitation, pure pluck and hard work. During the coming year they have contracted for a liberal supply of specially arranged advertising matter to aid them in pushing business.

The Commonwealth Power and Light Company, of Jackson, Mich., is negotiating for a $4,000 electric sign to place in front of its new and commodious quarters on West Main street.

The company now has by far the best show-rooms and windows in Michigan, and when the new sign is installed will be in a position to make people "sit up and take notice."

Mr. Lott expects to take over the equipment and contracts of the defunct Antwerp Electric Light Company and convey current from the central plant at Hicksville.

Central Station Work at Middlebury, Vt.

The recent remarkable growth of interest in the subject of illumination is well exemplified by the rapidity with which the movement throughout the country has spread. Naturally at the start the subject of better illumination was taken up in the larger cities, but the smaller places have in many instances not at all been behind in the endeavor to give the customer better illumination. As an example showing how the movement has spread to the smaller towns may be cited the case of Middlebury, Vt., a place of only 1,900 people. This town, under the efficient management of C. C. Wells, secretary and manager of the Middlebury Electric Company, is using a very large number of "Gem" lamps, equipped with proper Holophane reflectors, so that its store lighting is on the average superior to that of the larger cities.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Benjamin Outlet Box Receptacle.

The Benjamin Electric Manufacturing Company, Chicago, Ill., is placing upon the market a new No. 6-B receptacle especially designed for use with outlet boxes. It has a number of strong, attractive features, among which may be mentioned the following:

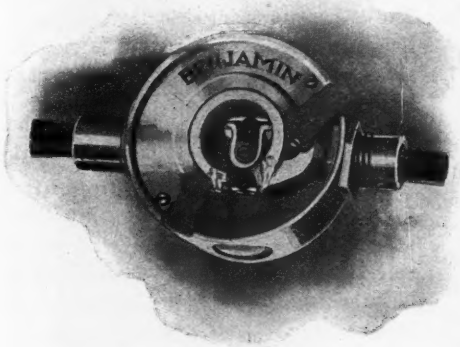


FIG. 1.—BENJAMIN OUTLET BOX RECEPTACLE.

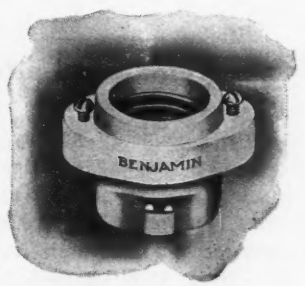


FIG. 2.—BENJAMIN OUTLET BOX RECEPTACLE.

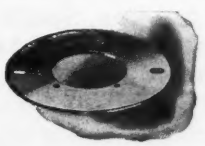


FIG. 3.—STEEL-PLATE BLACK-ENAMELED COVER.

The contacts do not project beyond the walls of the receptacle, and therefore do

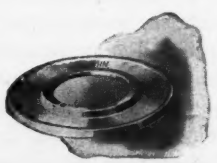


FIG. 4.—STEEL-PLATE POLISHED-BRASS COVER.

not readily come in contact with the metal parts of the box or projecting parts of

FIG. 5.—PLATE-BRASS COVER-HOLDER.

the conduit; the wires are easily spread around the base, thus making slack wire unnecessary; the binding screws are accessible from the front, obviating the necessity of reversing the receptacle, or of tapping wires to make connections, and it may be connected while in position in the box, the cover being attached after connections have been made. The receptacle is well shown in Figs. 1 and 2.

A steel-plate cover (Fig. 3) is furnished through which the porcelain receptacle slightly projects. Over this a polished-brass cover (Fig. 4) may be used with or without shade holder. Where a shade holder is desired, it is spun upon the brass plate, forming a neat and substantial device (Fig. 5).

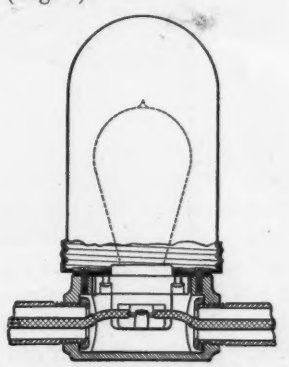


FIG. 6.—CROSS-SECTION OF BOX AND RECEPTACLE FOR PORT HURON TUNNEL OF THE GRAND TRUNK RAILROAD.

A special point of interest attaches to these receptacles in connection with their contemplated use in the Port Huron tunnel of the Grand Trunk Railroad. Fig. 6 shows a vertical cross section of the box to be used. It is of cast iron, with threaded outlets to receive the conduit, thus securing a water-tight joint. A rubber gasket extending from the outer edge to the centre opening, through which the socket projects is placed under the steel-plate cover. Both the outer edge and the socket are thus protected against moisture. If found necessary a vapor-tight globe will be screwed against the rubber gasket. If no globe is used, as will probably be the case with so tight a box, a rubber lamp ring will be substituted. Globe holders of sheet aluminum will be supplied.

Where it is deemed desirable to use a guard, provision is made for attaching it directly to the holder.

Additional Electrical Equipment for the West Jersey & Seashore Railroad.

Because of the increased traffic on the Camden-Atlantic City electric line of the West Jersey & Seashore Railroad, it has become necessary to add to the present rolling stock some twenty-one cars. Both the new cars and the generating apparatus necessary to care for the extra load are similar to the present equipment. Each of the cars will be driven by a GE-69 (200 horse-power) double-motor equipment and will be fitted with the Sprague-General Electric type M control.

At the Westville power-house a fourth 2,000-kilowatt, 6,600-volt, twenty-five-cycle, three-phase, Curtis steam turbo-generator will be installed. Additional boiler capacity, with the necessary condenser and feed pumps, switchboards, etc., will also form a part of the new equipment, as well as a seventy-five-kilowatt, 125-volt, horizontal Curtis steam turbo-generator for excitation purposes. Three extra 700-kilowatt, air-blast transformers will step-up the generator voltage to 35,000 volts for transmission.

Six 1,000-kilowatt rotary converters will be distributed in the substations, one each at South Camden, Glassboro, Newfield, Mizpah, Atlantic City, and one at the Westville power-house. The accompanying air-blast transformers for these machines have a capacity of 370 kilowatts each, three being installed with each of these rotaries. The Pennsylvania Railroad has ordered all the additional apparatus, as outlined, from the General Electric Company, which also furnished and installed the initial equipment.

10,000-Kilowatt Westinghouse Turbo Units for Rapid Transit Work in Brooklyn.

The Transit Development Company, of Brooklyn, N. Y., has given a large order for generating apparatus to the Westinghouse Machine Company, of Pittsburg, This transaction is distinctive in carrying not only the largest single order ever placed for power-generating machinery, but also units of the largest size contemplated at the present time. The new equipment will consist of five 10,000-kilowatt turbo-generator units and a large amount of converting, transforming and controlling apparatus, all manufactured by the Westinghouse interests.

The new unit is exceptionally compact. Over all, the turbine measures twenty-four and one-half feet in length, fifteen feet in width and twelve and one-quarter feet in height, above the floor level. This is equivalent to 3.8 brake-horse-power (rated) per square foot occupied, or five and two-thirds brake-horse-power maximum. Conversely, the turbine requires 0.026 square foot per rated brake-horse-power, or 0.018 square foot per maximum brake-horse-power. The combined unit measures approximately forty-eight and one-half feet in length, equivalent to 0.075 square feet per kilowatt rated, or 0.049 square feet per kilowatt maximum.

The turbine equipment is designed for a a steam pressure of 175 pounds at the throttle, 100 degrees superheat and twenty-eight-inch vacuum. Under these operating conditions assumed, the generators are capable of sustaining their full rated load continuously with a temperature rise of thirty-five degrees centigrade, with power-factor ranging from ninety to 100 per cent. In the event of loss of vacuum, accidental or otherwise, the turbines will automatically "go to high pressure" carrying their full-rated load without the assistance of a condenser. This feature will be obtained through the use of a secondary admission valve of construction similar to the primary valve and operated by the governor in such a manner as automatically to come into operation when the overload upon the machine reaches a certain point. The action of this valve is to raise the pressures in the various stages and thus increase the capacity of the machine.

In the construction of the generator the standard rotating-field design will be employed with frame entirely enclosed so as to facilitate forced ventilation, and incidentally obviate the noise emanating from high-speed turbines. Current may be delivered at 6,600 or 11,000 volts, according to the method of connecting the windings.

A good feature of the horizontal-type turbine is the excellent disposition which may be made of the condensing apparatus. In spite of the compactness of these large units, the surface condenser will be located, as usual, directly beneath in the power-house basement, together with all of the condensing auxiliaries, thus giving a clear engine room floor.

This new power equipment will be eventually installed in the new Kent avenue station, Brooklyn, where several large turbine units have been in operation for some time.

Self-Contained Belted Alternators.

The Allis-Chalmers Company, Milwaukee, Wis., has recently developed a line of small sixty-cycle belted alternators known as type AB. These machines are self contained and are built for outputs ranging from fifty kilowatts at 1,200 revolutions per minute to 150 kilowatts

SELF-CONTAINED BELTED ALTERNATOR.

at 900 revolutions per minute, two or three-phase. They can also be furnished for single-phase in outputs ranging from thirty-seven and one-half kilowatts at 1,200 revolutions per minute to 110 kilowatts at 900 revolutions per minute. As shown by the accompanying illustration, the bearings are supported in end housings bolted to the stator yoke so that the whole machine is self contained and requires no base. The stator yoke rests on slide rails to which it is bolted.

These machines are of the revolving-field type, the armature being stationary. The stator punchings are of selected steel carefully annealed. They are supported in a cast-iron yoke provided with numerous openings to allow free circulation of air.

All armature coils are form wound. As the slots are open, the coils can be readily removed. The projecting stator yoke and end housings completely protect the ends of the coils where they project beyond the laminated core.

The field poles are built up of steel laminations riveted between end heads and dove-tailed and keyed to a spider or hub. The field coils are wound with square wire, which makes a very compact and durable winding. Exciting current is supplied to the field through cast-bronze collector rings mounted on the shaft between the field and the outboard bearing. The bearing housing has three arms, as shown in the illustration, thus leaving the space around the collector rings and brushes easily accessible. Each ring is provided with two brushes. The machine illustrated has the shaft extended to receive a pulley for driving a belted exciter. They can, however, be furnished without extended shaft. The bearings are of the ring-oiling, self-aligning type and are of liberal dimensions. Both bearings are of the same size.

The manufacturers state that the electrical performance of these alternators is good, as the fields have sufficient margin for handling inductive loads, the efficiency is high and the rating conservative.

Compania Minera Borda Antigua y Anexas, South America, purchases Electric Machinery.

The Compania Minera Borda Antigua y Anexas, South America, whose mines are located close to the Dos Estrellas mines, near Tlalpujahua, has recently placed an order with G. & O. Braniff & Company for an electrical installation for its mines. The motors, transformers, etc., will come from the works of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., and the pumps from the Byron Jackson Machine Works, of Oakland, Cal.

There is already on the ground, being erected, a 250-horse-power Lidgerwood Manufacturing Company steam hoist, purchased before electric power entered the camp. The Westinghouse company will attach to this hoist one of its standard 150-horse-power alternating-current hoist motors, the only necessary change in the hoist being the adding of gear and pinion to adapt the drive.

In the way of pumping outfits there will be provided four horizontal centrifugal pumps, direct-coupled to alternating-current motors; also two motors for driving a blower for ventilating the mines.

Direct-Acting Time-Limit Circuit-Breaker.

The Cutter Company, of Philadelphia, has for some years been working upon a form of circuit-breaker which would have a direct-acting time-limit feature. This is now ready for the market.

The "Dal-Ite" feature, as the new time-limit attachment is called, is in reality a start-delaying device—that is, the initial motion of the tripping plunger or armature of the circuit-breaker is delayed so that in case of a momentary and not too heavy or dangerous overload, this part of the circuit-breaker will not immediately be brought into play, but will remain inert. When, however, the overload has been maintained for a dangerous period of time, or in the event of a short-circuit, the action of the plunger or armature is practically instantaneous. It is this delayed start, combined with complete freedom from restraint throughout the entire movement of the tripping armature, which constitutes one of the essential features of the "Dal-Ite" as compared with other forms of time-limit apparatus.

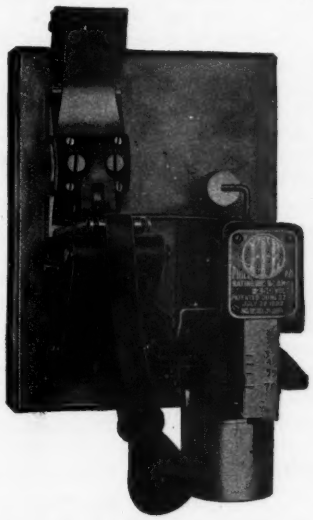


FIG. 1.—SINGLE-POLE OVERLOAD CIRCUIT-BREAKER FOR SMALL FEEDERS.

As this time-limit feature is directly connected to the tripping plunger or armature and forms a part of it, it is a direct-acting device which limits the duration of the overload on a well-established "I-T-E" principle. It is from this that the coined name is taken, meaning direct-acting limit inverse time element. This direct action upon the plunger or armature is another feature which distinguishes this circuit-breaker from other time-limit devices.

The maker states that the "Dal-Ite" circuit-breaker has already demonstrated its reliability, not only in the many tests to which it has been subjected in the laboratory, but also in commercial use.

By referring to the illustrations it will be seen that the point of departure from the standard I-T-E circuit-breaker is found in the little cylindrical attachment placed immediately below the housing.

The cylindrical vessel above referred to contains a seat for a circular disc which is suspended from the armature cooperating with the restraining latch. The engaging faces of the disc and its seat are accurately surfaced, and the disc is supported in such a manner that it may perfectly align itself with its seat. The disc when seated is surrounded with a shallow bath of specially prepared oil, serving to exclude air from between the engaging faces, which are thus separated only by a thin film of oil. The intimate engagement of the disc with its seat causes an additional restraint upon the armature proportional to the total pressure of the atmosphere upon the upper surface of the disc.

In the event of overload, the pull of the armature communicated to the disc causes a gradual extension of the oil film, until,

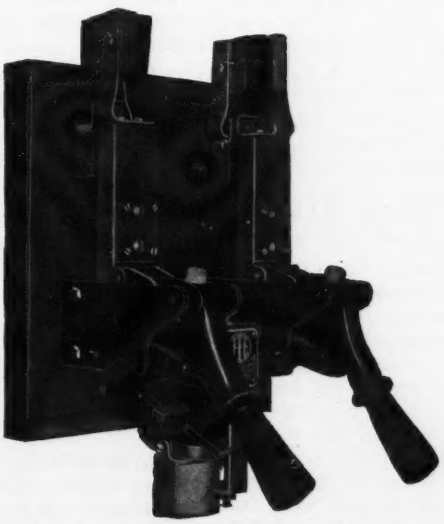


FIG. 2.—OVERLOAD CIRCUIT-BREAKER FOR MOTOR PROTECTION.

if the overload be sufficiently long continued, the film is finally ruptured, the disc is suddenly released and the armature, which now moves forward without restraint, causes the opening of the circuit-breaker in the usual manner. While the force necessary to rupture the oil film is very considerable, the movement required is almost microscopic, a fact which contributes greatly to the accurate working of the device. To separate the disc from its seat a certain definite amount of work must be done, the stronger the pull communicated by the armature to the disc the more quickly this work will be accomplished, and the more promptly the circuit-breaker will be opened. The time element is, therefore, inversely proportional to the pull of the overload magnet, which in turn is proportional to the square of the current. As a result of these conditions the time required to cause the opening is nearly inversely proportional to the square of the overload current or directly proportional to its heating effect.

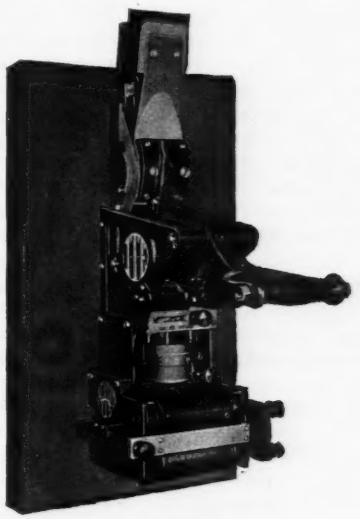


FIG. 3.—CIRCUIT-BREAKER WITH ADJUSTABLE TIME-LIMIT FEATURE.

The "Dal-Ite" feature can be supplied in connection with single-pole, double and triple-pole overload circuit-breakers; for overload and no-voltage, and for overload and reverse-current circuit-breakers. It is equally adapted for alternating-current and direct-current work.

In the types of circuit-breakers intended for motor protection, the new feature is not susceptible of adjustment; for the larger and more important forms of breaker the period of retardation is adjustable from zero to maximum.

Several types of the new circuit-breaker are shown in the accompanying illustrations. Fig. 1 shows a single-pole overload circuit-breaker adapted for the protection of small feeders and lighting circuits.

In Fig. 2 is shown an overload circuit-breaker especially designed for motor protection.

The approved form of circuit-breaker for generator protection has overload and reverse current, with the time-limit feature subject to adjustment, as shown in Fig. 3.

Current Electrical News

DOMESTIC AND EXPORT.

TELEPHONE COMPANY TO INCREASE CAPITAL STOCK—The Cincinnati & Suburban Bell Telephone Company, Cincinnati, Ohio, has decided to increase its capital stock from $5,000,000 to $8,000,000. The shareholders will be asked to approve the proposition at the annual meeting to be held February 20. It is proposed to issue $500,000 of the new stock on March 1 to shareholders at par.

PROPOSED ELECTRIC LINE FROM CHICAGO TO DENVER—The Chicago & Southwestern Electric Railway Company has been chartered at Guthrie, Okla., with $250,000,000 capital stock, to build an electric line from Chicago to Denver, Col. The total length of the line is 2,500 miles, the total cost to be $200,000,000. B. M. Dunn and Louis F. Rabe, of Chicago, are the main incorporators. The Central Construction Company, of Chicago and Guthrie, has been chartered with $500,000 capital to build the proposed line.

NEW PLANT FOR UTAH LIGHT AND RAILWAY COMPANY—The Utah Light and Railway Company will construct a 25,000-horse-power plant on the Jordan river, Utah, work to commence at once. At the present time the company draws its power from four different plants—one near Provo, another at Garland and another near the mouth of the Big Cottonwood canyon. The fourth and largest is the plant near the Jordan, which at present occupies the site of the proposed structure, and which has a capacity of 6,000 or 7,000 horse-power. The maintenance of these different plants is expensive and the service unsatisfactory. The new plant is designed to do away with these drawbacks.

DUTY ON NIAGARA CURRENT—The Canadian government has decided to impose an export duty on electrical energy from Niagara Falls with the object of obtaining for Canadian consumers at reasonable rates all power which they require. It will be provided that a company which complies with the regulations which the government will lay down may be relieved from the payment of export duty. At Niagara Falls, it is alleged, United States capitalists have perfected plans for meeting the demand for electrical energy at points south of the international boundary line, regardless of the wants of the Canadian consumers. The Dominion government will insist upon the Canadian market getting all that it needs; otherwise, the export duty will be made effective. The duty will be fixed by the House of Commons and will probably be $10 a horse-power.

LIGHT AND POWER MERGER—The merger of the Western Gas and Electric Company and the Western Power Company, an eastern corporation operating in counties of northern California, takes in, it is said, the property of the Pacific Gas and Electric Company, which includes a combination of the Independent, the California Gas and Electric Company and other corporations furnishing gas, heat and power in San Francisco which had been absorbed by the original gas company. The California Gas and Electric Company was controlled by John Martin and Eugene De Sabla. It supplied light and power to several towns and cities in northern and central California, including Sacramento, Oakland and San Francisco. In San Francisco power was furnished to the United railroads and other large consumers. The Great Western Power Company has issued bonds valued at $25,000,000 in New York for the purpose, it is said, of financing the proposed merger.

NEW MASSACHUSETTS ELECTRIC ROAD—The directors of the Boston & Providence Interurban Electric Railroad have filed with the Massachusetts board of railroad commissioners a petition for a certificate that public necessity and convenience require the construction of an electric railroad from Forest Hills to the city of Providence, R. I. The plan of the proposed road, which is filed with the petition, shows that it is the intention of the directors practically to parallel the tracks of the New York, New Haven & Hartford Railroad, going through the towns of Hyde Park, Dedham, Westwood, Canton, Sharon, Foxboro, Mansfield, Attleboro and Seekonk, a distance of thirty-one and one-quarter miles in Massachusetts. The directors of the company are: James L. Richards, H. Heustis, of Newton; Frederick S. Pratt, Russell Robb and Frederic E. Snow. The capital stock is said to be $5,000,000, and the estimated cost of the road is $4,730,819.75.

MEXICAN ELECTRICAL NOTES—The street-railway system in San Luis Potosi has been sold to Jose Dominguez for $250,000. Mr. Dominguez will extend the system and will convert it from mule to electric traction. It is reported that he will expend several hundred thousand dollars in making these improvements. E. C. Breton, president of the Tampico street-railway system, is preparing to convert the mule car lines into electric transit and to extend the system to the beach, six miles distant. He is also negotiating for the purchase of the electric light plant at Tampico. A company of Mexican capitalists has been formed for the purpose of constructing a system of electric railways in Parral. Rodolfo Valles is president of the company, which has a capital stock of $110,000. The proposed system will traverse all of the principal streets. The contract for its construction will be let as soon as the surveys are finished. J. C. Dillert, of San Francisco, has been investigating the situation at Mazatlan with the view of constructing a system of electric street railways. It is reported that E. H. Harriman interests are back of the project. It is planned to have the new system finished and ready for operation by the time the extension of the Southern Pacific Railroad is completed to Mazatlan.

PERSONAL MENTION.

MR. FRANK CALLAHAN, superintendent of the Citizens' Electric Illuminating Company, Pittston, Pa., has resigned.

MR. PAUL A. WHITE has resigned as manager of the Bell Telephone Company's office at Ithaca, N. Y., to engage in a private enterprise.

MR. D. L. PRENDERGAST has been appointed secretary of the Boston Elevated Railway Company *pro tem* in place of John T. Burnett, resigned.

MR. C. S. VAN DYKE, who for some time has been assistant to the general manager of the Schenectady Illuminating Company, Schenectady, N. Y., has been made superintendent of the company.

MR. C. C. LEWIS, manager of the Bell Telephone Company's exchange at Delaware, Ohio, has resigned. He is succeeded by Mr. J. L. House, who has been in the company's service at Fremont, Ohio.

MR. R. H. GAMWELL, for the past two years general manager of the property of the Greensboro (N. C.) Electric Company, has tendered his resignation. Mr. Gamwell will be succeeded by Mr. Ernest Gonzenbach.

MR. W. D. HARRIS, traffic manager of the Indiana, Columbus & Eastern Traction Company at Newark, Ohio, has been chosen passenger traffic manager of the Everett-Moore syndicate, with headquarters at Akron, Ohio.

MR. S. B. VAN NESS, of Rochester, N. Y., has been appointed assistant general manager of the Rochester & Southern Construction Company, organized to construct a trolley line from Rochester to Elmira for the Rochester-Corning-Elmira Traction Company.

MR. W. P. READ, who has been superintendent of railway service for the Utah Light and Railway Company, Salt Lake City, Utah, for the past seventeen years, has resigned. His work will hereafter be carried on by Mr. F. L. Morse, assistant to the president of the company.

MR. E. L. BROOME has resigned his position as steam engineer of the New York Central & Hudson River Railroad Company to join the forces of the Stone & Webster Engineering Corporation, of

Boston, Mass. Mr. Broome will be succeeded by W. C. Miller, Jr., formerly assistant steam engineer.

MR. B. J. WALLINGFORD, who for more than twelve years has been superintendent of the Electric Appliance Company, has resigned to take charge of northern Illinois sales for the Ajax Line Material Company. Mr. Wallingford was presented by his associates in the Electric Appliance Company with a handsome gold watch and chain as a mark of their esteem.

MR. JOHN E. SEWELL, general manager of the Connecticut Railway and Lighting Company's system for twelve years, and general manager *pro tem* of the Consolidated Railway Company since it took over the Connecticut Railway and Lighting Company, announces that his services with the Consolidated will terminate on February 1. Mr. Sewell will retire to private life.

MR. H. P. WATSON, manager of the Mobile (Ala.) exchange of the Southern Bell Telephone and Telegraph Company, has been promoted to be special agent to Superintendent F. L. Woodruff at Montgomery. Mr. Watson has been manager of the Mobile exchange for the past twenty years and has made a remarkable record of success. Mr. J. D. Anderson, assistant superintendent at Montgomery, will succeed Mr. Watson as manager at Mobile.

MR. H. J. LAMBORN has been appointed superintendent of power and plant in the Yale & Towne works, to succeed Mr. F. A. Waldron, who resigned about a year ago. Mr. Lamborn was born in Philadelphia in 1873, and graduated first from the Philadelphia High School and later from the Towne Scientific School of the University of Pennsylvania in the course of mechanical engineering. For three years he was associated with Mr. John C. Trautwine, Jr., in editorial work for the "Civil Engineer's Pocketbook"; then for four years connected with the engineering department of the United States Army on harbor and fortification work near Philadelphia, and then for a year with the Hyatt Roller Bearing Company as mechanical engineer. Since 1902 he has held the position of mechanical and electrical engineer and superintendent of the magnetic separating plants of Witherbee, Sherman & Company, at Mineville, N. Y. (on Lake Champlain). Mr. S. E. Dauchy, who has been acting superintendent of power and plant during the past year, and for several years has held the position of assistant superintendent, will continue in the latter capacity under Mr. Lamborn.

NEW MANUFACTURING COMPANIES.

ALBIA, IOWA—The Acme Telephone and Manufacturing Company has been incorporated with $25,000 capital.

RENO, NEV.—The Hudson Electric Company has filed articles of incorporation, with principal place of business at Reno. The company is capitalized at $5,000, with J. E. Davis, M. E. Davis and John F. Brown as incorporators, and will deal in electrical supplies.

CHARLESTON, S. C.—The Charleston Electrical Supply Company has been organized with the following officers: president, H. M. Franks; vice-president, D. S. Lewis; secretary and treasurer, Robert Riggs; directors: Henry F. Welch, B. F. McLeod, Frank Cooper, D. G. Dwight, A. Meyers, D. S. Lewis and H. M. Franks.

DOVER, DEL.—The Electrical Securities and Construction Company, of New York city, has filed incorporation papers at Dover with a capital stock of $1,000,000. The company is to manufacture, sell and deal in electrical appliances of all kinds. The incorporators are Charles J. Peabody, Brooklyn, N. Y.; Arthur E. Goddard, New York city; Harry W. Davis, Wilmington, Del.

ELECTRICAL SECURITIES.

Although there was a severe break in the stock market on Friday of last week, it is not thought that a speculative crisis is impending. Indeed, it is held that the extensive liquidation of securities has had a beneficial effect on the money market. Many severe declines were made, ranging from five to ten per cent, but these low prices, it is hoped, will influence foreign buyers. Some disappointment was felt, due to the fact that there was no increased dividend on Amalgamated Copper. Figures for the country's foreign trade in 1906 were made public, these being the largest for both exports and imports for any similar period.

ELECTRICAL SECURITIES FOR WEEK ENDING JANUARY 19.

New York:	*Closing.*
Allis-Chalmers common	14½
Allis-Chalmers preferred	37⅞
Brooklyn Rapid Transit	77
Consolidated Gas	134½
General Electric	157
Interborough-Metropolitan common	35⅛
Interborough-Metropolitan preferred	72
Kings County Electric	140
Mackay Companies (Postal Telegraph and Cables) common	71
Mackay Companies (Postal Telegraph and Cables) preferred	69¾
Manhattan Elevated	142¼
Metropolitan Street Railway	105½
New York & New Jersey Telephone	110
Western Union	83⅝
Westinghouse Manufacturing Company	150¼

It is understood that the entire amount of preferred shares of $50,000,000 of the Mackay companies has been issued. No further issue can be made without a vote of the shareholders. In the annual report of the Mackay companies as of February 15, 1906, the outstanding preferred shares were $40,645,600. There has therefore been issued since that time $9,354,400 of the preferred shares, which have been issued in exchange for telephone and telegraph stocks yielding as much as, or more dividends than, those on the preferred shares thus issued.

Boston:	*Closing.*
American Telephone and Telegraph	128½
Edison Electric Illuminating	228
Massachusetts Electric	68
New England Telephone	121
Western Telephone and Telegraph preferred.	80

Directors of the Western Telephone and Telegraph Company have declared the regular semi-annual dividend of $2.50 per share on the preferred stock, payable February 1 to stockholders of record January 19. The books closed January 21 and will reopen January 31.

The instrument output of the American Telephone and Telegraph Company for the month ended December 31, 1906, is as follows: gross output, 163,260; returned, 71,483; leaving net of 91,777. For the twelve months of 1906 the net output was 1,409,578. The total outstanding is 7,107,836.

Philadelphia:	*Closing.*
Electric Company of America	10⅝
Electric Storage Battery common	65
Electric Storage Battery preferred	65
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	20½
United Gas Improvement	92¼

The Philadelphia Rapid Transit subsidiary lines at their annual meetings reelected old directors and officers.

Chicago:	*Closing.*
Chicago Telephone	115½
Chicago Edison Light	148
Metropolitan Elevated preferred	71
National Carbon common	84¼
National Carbon preferred	117
Union Traction common	—
Union Traction preferred	—

It is planned that a board of control of five Chicago citizens act as trustees for the stock of the Chicago Railway Company until Union Traction internecine troubles are settled and courts distribute the assets. Four members have been named: A. C. Bartlett, Chauncey Keep, Charles H. Hulbert and A. A. Sprague.

Chicago Telephone closed the year with 170,883 telephones in service, as compared with 143,223 at the end of 1905, 36,414 in 1900 and 13,869 in 1895.

The four local elevated companies last year carried 131,956,282 passengers, an increase of 8,297,997, or 6.28 per cent over 1905. Metropolitan gained 4,402,979, or more than half the total increase. South Side has been losing since the Chicago City Railway has improved its surface accommodations.

ELECTRIC RAILWAYS.

CAMDEN, MICH.—The town board has granted a thirty-year railway franchise to L. B. Shannon.

ASSUMPTION, ILL.—The Springfield & Southeastern Traction Company has been granted a franchise by the village board.

CLEVELAND, OHIO—The Lake Shore Electric Railway Company shortly will sell $500,000 six per cent collateral trust gold notes.

ALBANY, N. Y.—The United Traction Company has planned to double track its new subsidiary line, the Hudson Valley Railway, and make many other improvements to it.

LANSING, MICH.—George Mindeman, of Kansas City, is said to be promoting an electric railway to connect Lansing, Charlotte, Albion and Toledo. An old survey between Charlotte and Albion would be used.

DOYLESTOWN, PA.—The Bristol-Trenton-Philadelphia Trolley Company has passed into the hands of the United Power and Transportation Company of Trenton, the same road that controls the Trenton Railway.

BOSTON, MASS.—The Gardner, Westminster & Fitchburg Street Railway has petitioned the railroad commissioners to issue $35,000 twenty-year five per cent bonds, the proceeds to be used to retire the floating debt.

CHEMUNG, N. Y.—A permit, giving the Elmira, Corning & Waverly Trolley Company the right to continue its line through the towns of Chemung and Ashland, has been issued by the state engineering department.

ROCKPORT, IND.—The same syndicate that is building the electric line from Rockport to Evansville will build one from Rockport to New Albany *via* Grandview, Troy, Tell City and Cannelton. Work will commence in the spring.

TAYLORVILLE, ILL.—The St. Louis, Decatur & Champaign Traction Company has decided to construct a line from Decatur to Litchfield through Taylorville. Another interurban road is being built from Pana to Springfield through Taylorville.

LANSDOWNE, PA.—A charter has been granted by Governor Pennypacker for the extension of the Philadelphia Rapid Transit Company's trolley line from Darby to Sixtieth and Market streets, Philadelphia, going through Lansdowne and Cardington.

TOLEDO, OHIO—The Toledo & Chicago Interurban Railway Company, through its attorney, F. L. Welshmeier, has filed condemnation proceedings for all of the right of way adjoining the Lake Shore Railway, on the south between Waterloo and Butler.

FAIRFIELD, IOWA—It is reported that the Iowa & Missouri Traction and Power Company will let contracts at once for the construction of its lines from Fairfield to Memphis, Mo., about fifty-two miles. Harrison Blacklege, Keosauqua, Iowa, is president of the company.

ROCKVILLE, CT.—C. W. Blakeslee & Son, of New Haven, who have the contract for building the Stafford and Rockville electric road from Stafford Springs to Crystal Lake, have taken the contract to build the remainder of the road from Crystal Lake to Rockville for the Consolidated Railway Company.

ROME, GA.—Directors of the Rome Railway and Light Company have authorized the issue of $500,000 five per cent bonds, maturing in thirty years, to be sold at par. Three hundred thousand dollars of the funds will be used to retire the bonds of the City Electric Railway, whose properties the present company took over, and $200,000 is to be devoted to improvement of equipment.

LONG BEACH, L. I.—In connection with the development of this seashore resort by a syndicate, the Seashore Municipal Railroad Company, a corporation of which Roland B. Lamb is general manager, proposes to run a trolley from Hempstead to Rockville Centre, thence to East Rockaway and through Ocean Side to Long Beach.

STOCKTON, CAL.—An attempt will be made to raise a bonus of $20,000 in Stockton and vicinity to build an electric road from Byron to this city. Local capitalists have promised to subscribe liberally. If the bonus can be raised the proposition of financing the road will be taken up by the Central California Traction Company, which owns the new street-car lines in Stockton and is connected with the American River Electric Company.

NORRISTOWN, PA.—The charter for the Lederachville & Pennsburg Electric Railway Company has been filed. This company will operate a trolley line from Lederachville through the township of Marlborough to Pennsburg. The capital stock of the company is $100,000. George Hoeger, of Norristown, is president, and the directors are William S. Lambert, Reading; William C. Riffert, Dauphin; Michael A. Kelley, West Pittston, and John F. Lederach, Lederachville.

SEATTLE, WASH.—In the granting of a franchise by the Puyallup city council to the Puget Sound Electric Railway the first step was taken for the construction of an electric third-rail system, connecting the towns of Orting, Sumner and Puyallup with Seattle and Tacoma. Jacob Furth, of Stone & Webster, announced that the line would be built as soon as the material can be obtained and the final details completed. The right of way has been acquired and the survey made.

CHESAW, WASH.—The county commissioners have granted a franchise to the Okanogan Electric Railway to construct its line from Nighthawk to the Columbia valley through Okanogan county. A. M. Dewey, the leading spirit in the new organization, announces that construction work will commence at once and that within eighteen months electric cars will be in operation. The route mapped out will take the road through the Pogue flat fruit country, which is being watered by the Okanogan project.

WINNIPEG, MANITOBA—Notice is given that an application will be made to the legislative assembly at its next session for an act to incorporate a company under the name of the Suburban Electric Railway Company, with power to construct, equip, maintain and operate a line or lines of railway with steam, electric, gasolene or other kind of motive power, for the conveyance of passengers and freight from Winnipeg westerly and northerly to a point at or near the shore of Lake Manitoba, in the province of Manitoba.

COLORADO SPRINGS, COL.—W. C. Doterer and Wesley Compton, representing eastern capitalists, have been granted twenty-five-year franchise rights for an electric line on the streets of Manitou. The company plans to construct its line to Crystal Park, nine miles, along the abandoned roadbed of a steam line projected twenty years ago, to the summit of Pike's Peak. The total investment will reach $250,000. Crystal Park, the property of the John Hay estate, is a popular summer resort, and the route is one of scenic grandeur.

WASHINGTON, D. C.—It is understood that plans are on foot for the construction of a double-track electric railroad from Washington, D. C., to Accotink, Va., passing through Alexandria and touching Mount Vernon and Pohick. It is said that E. H. Harriman and William Nelson Cromwell are connected with the interests back of the project, and that the route from Washington, after leaving the new highway bridge, has been mapped out, and efforts to secure the necessary right of way will be put forth in the near future.

MANCHESTER, N. H.—With the formal opening of the line of the new Goffs Falls, Litchfield & Hudson Electric Railroad, the last gap in the trolley connections between Boston and Concord, N. H., is filled. The trip will require between five and six hours, and will be one of the most picturesque electric-car rides in New England, following the banks of the Merrimac river most of the way between Lowell and Concord. The Goffs Falls, Litchfield & Hudson road establishes the first trolley connection between Manchester and Nashua, the two principal manufacturing cities of New Hampshire.

PITTSBURG, PA.—Applications for charters to construct a system of ten elevated street-railway lines in Pittsburg were refused at Harrisburg by the state board of elevated and underground railways. The applicant for the charters was a corporation organized by Attorney George M. Hosack. The state board, in rejecting the applications, gives as its reasons that there is now pending and undetermined before the city councils of Pittsburg an application for an underground system of railways covering all or many of the same streets. The board states that the applications of the Hosack syndicate are dismissed without prejudice, which signifies that the applications can be renewed at any time and again considered by the board.

ELECTRIC LIGHTING.

MAGNOLIA, MISS.—The mayor and board of aldermen have contracted with the Magnolia Electric Light Company to furnish street lights during 1907.

ATLANTA, GA.—The city council of Americus failed to grant either of the two petitions for electric lighting and street railway franchises asked for by local companies.

MT. CLEMENS, MICH.—The contract for the city's incandescent lighting at a price of six and three-fourth cents has been signed with the St. Clair Edison Company, which will consolidate with the local company February 1.

CRESTON, IOWA—The stockholders of the Creston Mutual Electric Light, Heat and Power Company have elected the following officers: president, J. C. Sullivan; vice-president, C. S. Rice; secretary, W. H. Brady; treasurer, E. A. Aldrich.

HIGH POINT, N. C.—This city has abandoned for the present, at least, the project of municipal ownership of its electric light plant, and has entered into an agreement with O. N. Richardson for another term to furnish power for the said plant.

EASTHAMPTON, MASS.—The Easthampton Electric Company has filed with the selectmen a petition asking that there be granted to it locations for poles and wires in the streets of this town for the purpose of enabling it to furnish electricity for heat, light and power.

JAMESTOWN, N. Y.—At a special meeting of the trustees of the village of Lakewood, Edward P. Bailey and Charles D. Cole, of the Jamestown Electric Company, were granted a franchise for the erection and installation of an electric light and power plant in the village of Lakewood.

LOS ANGELES, CAL.—The Edison Electric Company announces a reduction in rates for light and power service. The maximum rate for lighting is reduced from eleven cents to ten cents per kilowatt-hour, and the maximum rate for power is reduced from ten cents to nine and one-half cents per kilowatt-hour.

HARRISBURG, PA.—The application of the Harwood Electric Transmission Company, of Philadelphia, with a capital of $5,000, for a perpetual charter to operate in Columbia, Luzerne, Schuylkill, Carbon, Berks, Northumberland and Lehigh counties, has been refused by Governor Pennypacker. No reason is assigned by the governor for refusing the application.

DANBURY, CT.—The Danbury & Bethel Electric Light and Gas Company will remodel its present plant completely and install 400 kilowatts in additional machinery. The improvements include a complete steam plant building and a coal storage plant. W. S. Barstow & Company, of New York and Portland, Ore., will do the engineering and supervise the work of installation.

CHICO, CAL.—The Chico Gas and Electric Company during the next two months will completely overhaul its power and lighting service in this city, and rewire the city, plans to this end having been perfected by the officials of the company. Important changes will be made. The street lighting system will be changed from the series to the multiple and additional transformers installed.

GUTHRIE, OKLA.—The Shawnee Lighting Company, of which D. T. Flynn, of Oklahoma City, is president, has sold its electric plant and power system at Shawnee to the Shawnee Gas and Electric Company, of which Sinclair Mainland, of Chicago, is president. The deal carries with it the contracts for furnishing power to the interurban and city lines, and also the Shawnee lighting contract.

MILWAUKEE, WIS.—The council committee on street lights has adopted a resolution to allow the Milwaukee Electric Railway and Light Company $65 a year per arc light on bills unpaid since December, 1905. The recommendation carries the clause that this sum be paid until the municipal light plant is completed. The same committee on a former occasion recommended that $78 be paid, but no action was taken by the council.

LOUISVILLE, KY.—At the annual meeting of the Kentucky Electric Company the board of directors and officers of the company elected when the company was organized recently were reelected as follows: Donald McDonald, president; Bryan H. Allen, secretary; directors, Lawrence Jones, Saunders Jones, Louis Seelbach, C. J. Kirwin, W. P. Semple, Daniel E. Doherty, Charles J. Doherty, John Starks, Matt O'Doherty, Donald McDonald and Baylor Hickman.

CAMBRIDGE, MD.—The stockholders of the Dorchester Electric Light and Power Company have elected directors to serve for the coming year as follows: D. H. LeCompte, John G. Mills, Geo. W. Woolford, Dr. B. W. Goldsborough, S. Lehman, A. J. Dunn and James C. Leonard. The incorporators of the company secured a charter from the Maryland legislature of 1900, and claim the right under the same to erect poles and string wires through the streets of Cambridge.

GARDEN CITY, KAN.—The Garden City electric light plant and Menke roller mill, both owned by D. R. Menke, and the Garden City telephone system, owned by E. L. Wirt, have been sold to Colorado Springs capitalists and one or two local capitalists. A new company will be organized with a capital of $150,000. The plan of the new company is to increase the size of the light plant and telephone system and give Garden City better service than has been possible heretofore.

LANCASTER, PA.—At a meeting of the stockholders of the Strasburg Light, Heat and Power Company a temporary organization was effected as follows: secretary and treasurer, L. J. Bair; directors, W. K. Bender, H. S. Hunsecker, I. Haines Dickinson, B. F. Brown and L. J. Bair. The capital stock was fixed at $50,000, and a committee was appointed to make application for a charter. The company intends adding to its present plant at Edisonville the water power at Wheatland Mills and transmitting energy to Quarryville, New Providence and Refton.

HOLYOKE, MASS.—Manager W. H. Snow, of the gas and electric department, has filed his fourth annual report. The most important announcement is the reduction in price of the street arc lights from $80 to $60 per year, making a total reduction of $10,000 in the cost of these lights. According to the report the department has increased its business 8.3 per cent in the gas works and 35.6 per cent in the electric station. More than two miles of gas mains have been laid. A 1,000-kilowatt turbo-generator has been installed and three new boilers have been ordered. Twenty-one miles of wire and 237 meters have been added.

NORWAY, MICH.—A. J. Lytle and associates have been granted a franchise and lighting contract at Iron River, Mich. The name of the company will be the Menominee Range, Power and Development Company. The company also intends to light the following-named towns: Amasa, Spring Valley and Stambaugh, and to furnish current for the mines located at these places. The power will be secured for Hemlock rapids, located nine miles from the town of Iron River, on the Paint river. Three thousand horsepower will be developed. The company is capitalized at $200,000, and the cost of construction will be about $100,000. It intends later on to construct and operate an electric railroad. The parties interested are A. J. Lytle, of Norway, Mich., who will be general manager; Messrs. I. W. Byers, Fisher, Coe, Van Norman, Helgumo, of Iron River, Mich; M. Stapleton, E. A. Edmonds, of Rhinelander, Wis.; John Barnes, of Madison, Wis., and D. S. Pindell, of Sault Ste. Marie, Mich.

RICHMOND, UTAH—The plant of the High Creek Electric Light and Power Company will be placed in operation about February 15, furnishing light and power to the following towns: Preston and Franklin, southern Idaho; Richmond, Smithfield, Lewiston and Trenton, northern Utah. The present installation will consist of two 200-kilowatt generators, direct-connected to Victor wheels, under a head of 187 feet. The plant complete will cost about $85,000. It is the intention of the company to start work on a 3,000-horsepower hydroelectric plant on what is known as Blacksmith Fork river, in the south end of Cache Valley, this coming spring, which will give the company an output, all told, of about 4,000 horse-power. M. B. Gwinn is president of the High Creek Electric Light and Power Company; J. I. Shepard, secretary and general manager; A. K. Steunenberg, treasurer. T. E. Daniels, who for the past three years has been in the employ of the city of Logan, Utah, as chief electrical engineer, installing the city's electric plant, will take a similar position with the High Creek company.

TELEPHONE AND TELEGRAPH.

BUFFALO, N. Y.—A telephone company has been organized in Machias. Lines will be run to adjacent settlements with the central office in Machias.

LAUREL, MISS.—The Cumberland Telephone and Telegraph Company is installing new telephones at the rate prescribed by the state railroad commission in its order dated July 7 last—$1.65 instead of $2 per month for residence service.

HOUGHTON, MICH.—A movement is on foot in Houghton looking toward the organization of an independent telephone company. It is understood that the movement has back of it some influential capitalists, local and Chicago, and that an automatic service will be installed.

HONESDALE, PA.—The Wayne County Mutual Insurance Company has elected the following board of directors for the ensuing year: president, S. R. Crane, of Sebeck; vice-president, E. F. Tiffany, Pleasant Mount; treasurer, John H. Arms, Hawley; secretary, Perry A. Clarke, Honesdale.

SOUR LAKE, TEX.—The Western Union Telegraph Company has a large crew of men in the vicinity of Sour Lake employed in stringing wire along the route of the Colorado Southern, New Orleans & Pacific Railway, which is the extension of the Beaumont, Sour Lake & Western Railway.

HONESDALE, PA.—The Bell Telephone Company is building a line from Honesdale to Cherry Ridge. The local branch of the Consolidated Pennsylvania Company is rebuilding its line between Honesdale and Dyberry, after which it will construct a new line to Hoadleys and from there to Hawley.

ERIE, PA.—The Mutual Telephone Company is building a sixty-foot addition to the local exchange on East Ninth street, and is doubling its equipment and facilities in order to keep pace with its business. A new board will be installed which will give the company a capacity of 10,000 instruments.

PHILADELPHIA, PA.—The stockholders of the Keystone Telephone Company, at their annual meeting, elected the following directors: F. Wayland Ayer, Marcus Beebe, George Burnham, Jr., Nathan T. Folwell, Clarence L. Harper, James Collins Jones, George Kessler, Hercules Lippincott, Michael Murphy and Jacob E Ridgway.

OMAHA, NEB.—The Nebraska Telephone Company is now installed in its new building in South Omaha. The big telephone poles will be removed from the streets in the business part of the city. Last year conduits were built throughout the business section and all business wires are now located under ground. The cost of the improvements in South Omaha was about $115,000.

YORK, PA.—At the annual meeting of the York Telephone Company the following board of directors for the ensuing year was unanimously elected: Hon. D. F. Lefean, Charles C. Frick, George B. Rudy, H. H. Weber, Harry S. Wiest, Dr. W. S. Eisenhart, John McCoy. The board of directors immediately after the stockholders' meeting organized as follows: president, Charles C. Frick; vice-president, Hon. D. F. Lefean; secretary-treasurer, H. H. Weber; attorney, George S. Schmidt; general manager, George B. Rudy; finance committee, Charles C. Frick, Hon. D. F. Lefean, H. H. Weber.

SOUTH BEND, IND.—The South Bend Home Telephone Company has about 5,000 telephones in St. Joseph county. Of this number 3,000 are located in South Bend and 500 of them are automatic. The South Bend list includes 900 telephones used for business and 2,100 for residence purposes. The Mishawaka list includes a total of 644, of which 175 are business and 469 are residence telephones. In addition fully 1,000 rural instruments connect with the exchange and are operated either through South Bend, Mishawaka, Granger, River Park or New Carlisle. The company also connects with an additional 1,000 independent telephones located at North Liberty, Walkerton, Osceola, Klondike, Lapaz, Teegarden and Wyatt. The company expects a large increase in business during the coming season and has made ample provisions for service with that end in view. It is arranging to increase the farmer business of the county by fully 1,000 telephones and the city list by 500 additional subscribers.

NEW INCORPORATIONS.

TATAMY, PA.—Tatamy Light, Heat and Power Company. $5,000.

ODEBOLT, IOWA—The Eden Mutual Telephone Company. $5,000.

WALKER, IOWA—The Farmers' Mutual Telephone Company. $10,000.

ST. PAUL, MINN.—Western Power Company, St. Paul. $100,000. Incorporators: N. H. Clapp, A. E. Macartney, H. A. Abernathy.

ALBANY, N. Y.—Oriskany Hydroelectric Company, Utica. $500,000. Directors: G. W. Sanborn, E. H. Risley, Utica; M. J. Terry, Waterville.

SPRINGFIELD, ILL.—Princeton Light and Power Company, Princeton. $25,000. Incorporators: F. C. Duncan, H. E. Chubbuck, Cairo A. Trimble.

PIERRE, S. D.—Cascade Company, Cascade Springs. To operate a telephone system. $1,500. Incorporators: A. S. Beebe, Henry Fruday, W. P. Hamelstrom and Fred Nunenberg.

ALBANY, N. Y.—Frewsburg Electric Light and Power Company, of Frewsburg; to carry on operations in Frewsburg, Fentonville and Riverside in Chautauqua county. $3,000. Directors: William Rohn, C. J. C. Scholpp, Guy Stanley, Otis Moore and John V. Ehmen, all of Frewsburg.

ALBANY, N. Y.—Utica-Southern Railway Company, of Utica; to operate a line twenty-six miles long in Oneida and Madison counties; $600,000; directors: W. M. E. West, of Hamilton; M. W. Terry, of Waterville, and F. R. Baxter, of Utica. The Philmont Lighting and Power Company, of Philmont, Columbia county; $20,000; directors: M. G. Thomas and W. E. Cainey, of Philmont; W. A. Cochiana, of Brooklyn.

HARRISBURG, PA.—Selinsgrove & Freeburg Electric Street Railway Company; to build five miles of road in Snyder county; $30,000; president, E. H. Leader, Shamokin. Shenango Street Railway Company; to build two miles of road in Mercer county; $12,000; president, Edwin Repley, Sherman, N. Y. Jefferson & Wilson Street Railway Company; to build one and one-third miles of road in Allegheny county; $8,000; president, Hugh Miller, Dravosburg. Shannopin Electric Street Railway Company, to build six miles of road in Allegheny county; $72,000; president, S. J. Dugan, Coraopolis. Clodonia Street Railway Company; to build a line from Graffensburg to Gettysburg, a distance of thirteen miles; $120,000; president, M. C. Kennedy, Chambersburg. Coraopolis Street Railway Company; to build two miles of road in Robinson township, Allegheny county; $24,000; president, J. W. Arnas, Coraopolis. Big Valley Street Railway Company; to build twenty-seven miles of road, beginning at Mill Creek, Huntingdon county, and extending to Reedsville, Mifflin county; $162,000; president, R. W. Jacobs, Huntingdon.

NEW PUBLICATIONS.

PROCEEDINGS OF THE OHIO ELECTRIC LIGHT ASSOCIATION—The proceedings of the Ohio Electric Light Association, including a complete report of the convention held at Put-in-Bay Island, Lake Erie, Ohio, August 21, 22 and 23, 1906, have been published in book form. In addition to the papers and discussion there are lists of the members of the association and of the attendants at the convention.

MAPS OF THE NIAGARA POWER DISTRICTS—The Ontario Power Company, of Niagara Falls, Ontario, has issued a portfolio of five very excellent maps of the Niagara power districts. Map No. 1 shows the power district of the Ontario Power Company; No. 2, that of eastern Ontario and western New York; No. 3, the Welland canal; No. 4, Niagara Falls and vicinity, and No. 5, Buffalo, Depew and West Seneca.

EDUCATIONAL NOTE.

UNIVERSITY OF ILLINOIS—The annual inspection trip of the electrical engineering department of the University of Illinois, Urbana, Ill., was made from January 14 to January 20, and included visits to Pontiac, Chicago and Grand Rapids. The trip was made under the direction of Professor Morgan Brooks, Professor H. P. Wood and E. I. Wenger.

INDUSTRIAL ITEMS.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., will be pleased to send bulletin No. 1,040, describing and illustrating polyphase induction motors.

THE L. B. ALLEN COMPANY, INCORPORATED, Chicago, Ill., is distributing a neat calendar embellished with an illustration in color entitled "A Florentine Maiden."

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., has issued a striking folder calling attention to its electrical equipment which it has installed in cement mills.

THE STANDARD PAINT COMPANY OF CANADA, LIMITED, opened, on January 18, its new factory at Montreal, Quebec. The president and directors of the company gave a dinner at the Canada Club on this occasion.

PASS & SEYMOUR, INCORPORATED, Solvay, N. Y., manufacturer of "P. & S." electrical specialties and porcelain of special designs, has ready for distribution a retail discount sheet. This may be had upon application to the company.

THE AMERICAN CONDUIT COMPANY, New York city, reports a very rapid and healthy growth in its business. The company has found it necessary to secure larger quarters, and has moved its New York offices from 170 Broadway to 140 Nassau street.

THE GAIL-WEBB MANUFACTURING COMPANY, Buffalo, N. Y., has published a new booklet descriptive and illustrative of adjustable electric fixtures and portables for office and factory equipment. This booklet will be mailed to any one interested upon request.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has issued bulletin No. 59, superseding page 59 issued in June of last year. This bulletin gives a price list of Cutler-Hammer radial arm reversible controllers for cranes and hoists.

THE MORGAN-GARDNER ELECTRIC COMPANY, Twenty-seventh street and Shields avenue, Chicago, Ill., is distributing a calendar for 1907. This bears in illustration several forms of Morgan-Gardner mining machines and a photogravure by H. H. Cauldery.

THE DEAN ELECTRIC COMPANY, Elyria, Ohio, is sending out folder No. 6, describing the express type of telephone switchboards which it manufactures. The construction of the drops is explained in detail, as well as that of the switches and the arresters. The various styles of these switchboards are illustrated in this folder.

HARVEY HUBBELL, Bridgeport, Ct., will be pleased to send a copy of his 1907 calendar upon request. The large mat upon which the calendar pad is mounted is illustrated with reproductions of the various Hubbell specialties, the centrepiece being a beautiful reproduction in colors of the subject "Poppies," by Philip Boileau.

THE PIQUA BLOWER COMPANY, Piqua, Ohio, has been incorporated under the laws of Ohio with a capital of $50,000. This corporation will take over the interests of the Piqua Foundry and Machine Company, and will make a specialty of the manufacture of blowers and gas exhausters as developed by the latter company during the past two years.

THE AMERICAN CARBON AND BATTERY COMPANY, East St. Louis, Ill., has published a new price list of its motor brushes for railway motors. This includes all the ordinary types of carbon brushes. The company has also published a price list of its carbon brushes for stationary motors and generators. These lists supersede all previous lists and became effective the first of the year.

THE JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., is sending out a special notice calling attention to the care that is being taken in packing and sealing its galvanized iron wire to guarantee that purchasers are obtaining Roebling material when they ask for it. This notice describes the method of sealing the packages and the different qualities of galvanized telegraph wire which are manufactured.

FREDERICK PEARCE COMPANY, 18-20 Rose street, New York city, has ready for circulation a new announcement concerning its facilities for turning out a full line of electrical and scientific instruments of precision. The company purchased the business of the Willyoung & Gibson company about a year ago. Since then the space and equipment has been materially increased. Full information will be furnished upon request.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has prepared a handsome little diary for 1907. This contains some helpful notes on motors, including data on railway operation and shop driving, wire tables, gas-engine data, power station costs, strength of materials, some useful operating hints, and information regarding the various type of illuminants. The diary also contains an excellent map of the United States and their possessions.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued a booklet illustrating and describing the instruments which it manufactures. These include switchboards, wattmeters of various types, ammeters and voltmeters, instrument transformers and multipliers, and portable and measuring instruments, including voltmeters, wattmeters and ammeters. The booklet calls attention to the special features of these instruments and gives the shop designation.

W. S. BARSTOW & COMPANY, of New York and Portland, Ore., have contracted to do all the electrical work for a 800,000-barrel cement plant to be located on the outskirts of Montreal, Can., for the Fordwick company. The works will use about 2,500 horse-power in electric motors, and will take current from the Shawinigan power plant, eighty miles from Montreal. The property of the Fordwick company is about two miles in length by 600 feet in width, along the St. Lawrence river. Provision will be made for storing, adjacent to the works, 40,000 tons of coal.

THE ATLAS ENGINE WORKS, Indianapolis, Ind., has published bulletin No. 134. This is known as the general bulletin of illustrations and specifications, and deals with the various types of Atlas engines, specifications of which are given. These include single-valve, throttling, self-contained engines; automatic, self-contained engines for various duties; four-valve Atlas engines, and engines of the Corliss type. The bulletin contains also specifications of the various boilers manufactured by the company, including horizontal tubular boilers, internally fired boilers, locomotive boilers and boilers of the water-tube type. Dimensions of the various sizes of Atlas gasolene engines are also given.

Record of Electrical Patents.

Week of January 15.

841,105. RECORDING SIGNAL-TRANSMITTER. Rollin A. Baldwin, New Haven, Ct., assignor to Baldwin & Rowland Switch and Signal Company. A pair of coaxial contact wheels, the relative motion of which transmits the signal.

841,106. ELECTRIC REGULATOR. Joseph Bijur, New York, N. Y., assignor to the General Storage Battery Company. A centrally pivoted arm extends at an angle over the contact-segments.

841,138. INSULATING HANDLE CONNECTION. John H. Gault, Philadelphia, Pa. An insulating shell placed between two sections of the handle.

841,168. ANNUNCIATOR FOR HOTEL LETTER BOXES. Frederick Muschenheim, New York, N. Y. Placing a letter in a box automatically signals to the corresponding room.

841,188. DEVICE FOR DETECTING SUBTERRANEAN WATERS. Adolf Schmid, Berne, Switzerland. A small portable galvanometer.

841,215. ELECTRIC REGULATOR. William S. Andrews, Schenectady, N. Y., assignor to General Electric Company. The circuit is closed and opened by a vibrating strip under tension.

841,226. ELECTRIC TIME-SWITCH. James M. Chappel, Dallas, Tex. The switch-trigger is tripped by a clock.

841,232. ELECTRIC RHEOSTAT. William F. Dana and Henderson W. Knott, New York, N. Y. A series of resistances composed of graphite and clay are interposed between metal contact-plates.

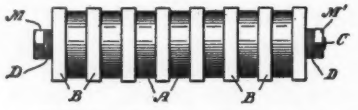
841,233. TELEPHONE SYSTEM. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A modified central battery system.

841,234. ROTARY SWITCH. Frank C. De Reamer, Schenectady, N. Y., assignor to General Electric Company. A snap-switch.

841,244. LISTENING APPARATUS FOR TELEPHONES. William W. Grigsby, Lawhon, La. A rotatable switch makes contact with any one of a number of listening circuits.

841,257. CONTROL OF ALTERNATING-CURRENT MOTORS. Marius C. A. Latour, Paris, France, assignor to General Electric Company. A compensated commutator motor.

841,270. ELECTRIC MOTOR-DRIVE. William B. Potter, Schenectady, N. Y., assignor to General Electric Company. A differential booster driven by the motor varies the voltage applied to the former.



841,232.—ELECTRIC RHEOSTAT.

841,292. TELEPHONE SYSTEM. Alfred H. Weiss, Evanston, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A magnetic system employing a source of steady current at the central office.

841,307. ELECTRIC ANNUNCIATOR. Charles C. Blake, Brookline, Mass., assignor to Western Electric Company, Chicago, Ill. A receptacle containing a colored liquid enables the target to be seen when in contact therewith.

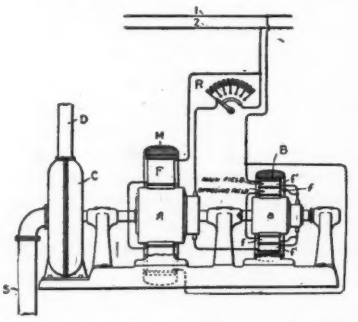
841,335. ADDING-MACHINE ATTACHMENT. Frank R. McBerty, Evanston, Ill., assignor to Western Electric Company, Chicago, Ill. A motor-driven device.

841,339. INCOMING TRUNK-LINE. Howard M. Post, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A supervisory relay is placed at the A board.

841,377. ELECTRIC SIGNAL FOR SPEAKING TUBES. Charles M. A. Costello and Frank H. Hart, New Haven, Ct., assignors to C. Cowles & Co., New Haven, Ct. An electric bell is attached to the tube.

841,386. WIRELESS TELEGRAPHY. Lee de Forest, New York, N. Y. An electrical oscillation selecting device consisting of an exhausted globe containing a filament and electrodes.

841,387. DEVICE FOR AMPLIFYING FEEBLE ELECTRICAL CURRENTS. Lee de Forest, New York, N. Y. An exhausted globe containing a sensitive conducting gaseous medium.



841,270.—ELECTRIC MOTOR-DRIVE.

841,397. TROLLEY-HEAD. Otto Hoffmann, Berlin, Germany. Shields project over the wheel.

841,399. COMPOUND TELEPHONE. Carl G. F. Holmgren and August E. Brahm, Stockholm, Sweden, assignors to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. An unperforated cover is mounted in front of the transmitter.

841,407. ELECTRICAL SWITCH. John A. Kennedy-McGregor, Birmingham, and Harry Wren, Bexhill, England, assignors to Harry William Cox, Nottingham, England. The blade is opened by the longitudinal movement of a pivoted bridge.

841,438. ELECTROMAGNETIC APPARATUS. Armin H. Pikler, Montclair, N. J., assignor to Crocker-Wheeler Company, Ampere, N. J. A method of mounting and clamping transformer windings.

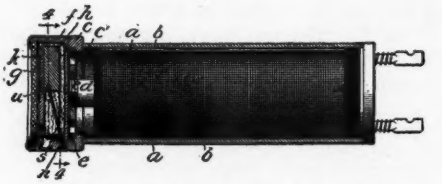
841,467. TROLLEY. Joseph Tetlow, Saco, Me., assignor of four-fifths to Herbert R. Jordan, Saco, Me. A trolley wheel with renewable parts.

841,476. ELECTRIC CALLING APPARATUS FOR TELEPHONES. Charles Adams-Randall, New York, N. Y. Two independent circuits are used, which are broken alternately by a vibrator.

841,478. SECRET-SERVICE TELEPHONE SYSTEM. Albert K. Andriano, San Francisco, Cal., assignor, by mesne assignments, to Direct-Line General Telephone Company, San Francisco, Cal. Secrecy is obtained by means of a number of interconnected lines.

841,491. TELEPHONE. Fred Edwards, Jefferson, Iowa. A switch, automatically cut in by the receiver-hook, may be opened by hand when the receiver is removed.

841,543. DYNAMO-ELECTRIC MACHINE. Marius C. A. Latour, Paris, France, assignor to General Electric Company. A machine of the commutator type employing two parallel windings in the slots at equal distances from the periphery.



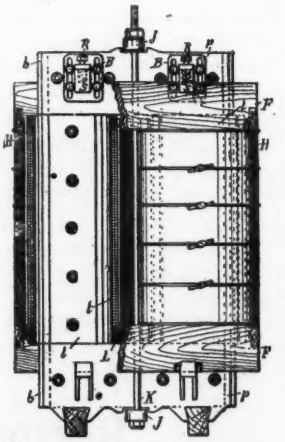
841,307.—ELECTRIC ANNUNCIATOR.

841,544. ALTERNATING-CURRENT MOTOR. Marius C. A. Latour, Paris, France, assignor to General Electric Company. A machine of the commutator type having a plurality of independent windings distributed in the slots.

841,545. DYNAMO-ELECTRIC MACHINE. Marius C. A. Latour, Paris, France, assignor to General Electric Company. A plurality of armature windings are carried in the same slots, but connected to successive commutator-segments.

841,557. AUTOMATIC ELECTRIC FIRE ALARM. William G. Meddings, Remuera, near Auckland, New Zealand. The alarm circuit is closed by the breaking of the fusible alloy.

841,599. COMBINED DYNAMO-MAGNETO IGNITION DEVICE. Joshua A. Struthers, Youngstown, Ohio, assignor of thirty-four one-hundredths to W. R. Beard, seventeen one-hundredths to J. Howard Parker, and twenty-four and five-tenths one-hundredths to C. F. Duchanois, Youngstown, Ohio. A magneto machine provided with auxiliary field-windings.



841,438.—ELECTROMAGNETIC APPARATUS.

841,607. RAILWAY SIGNALING MECHANISM. Edwin J. Adams, Waco, Tex. Signals are made in the locomotive cab.

841,609. MOTOR-WINDING. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. A phase-winding for a multispeed alternating-current motor.

841,610. ALTERNATING-CURRENT MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. A method of connecting a given number of poles and phases.

841,640. METHOD OF HARMONIC SELECTIVE SIGNALING. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. The moving parts of an electromagnet are tuned to absorb impulses of the proper frequency.